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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 13, NUMBER 1
JANUARY 1, 1980

W80-00001 -- W80-00400
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 1
JANUARY 1, 1980

W80-00001 -- W80-00400

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

WATER ANALYSIS,
Geological Survey, Lakewood, CO. Water Resources Div.
M. J. Fishman, and D. E. Erdmann.
Analytical Chemistry Reviews, Vol. 51, No. 5, p 317R-341R, April 1979. 546 ref.

Descriptors: *Reviews, *Chemical analysis, *Laboratory tests, *Analytical techniques, Inorganic compounds, Organic compounds, Gases, Radiochemical analysis, Isotopes, Instrumentation, Automation, Spectrometers, Measurement, Pollutant identification, Bibliographies.

A literature review covering water analysis for the period October 1976 through September 1978 is presented. The areas reviewed are determinations of alkali metals, hardness, alkaline-earth metals, Fe, Mn, Al, Cr, Cu, Zn, Pb, Cd, Ni, Co, Bi, Hg, Au, Mo, V, W, U, Th, Tl, Ce, B, P, SiO2, Se, As, Sb, Ge, Te, Cl, Br, F, I, So4, S2, No3, No2, N compounds, alkalinity, carbon dioxide, pH, specific conductance, biochemical and chemical oxygen demand, total carbon, oxygen and other gases, detergents, pesticides, herbicides, organic substances, and radioactivity and isotopic analysis. A bibliography containing 538 literature citations is included. (Woodard-USGS)
W80-00217

SOME LARVAE OF DIAMESINAE AND PODONOMINAE, CHIRONOMIDAE FROM THE BROOKS RANGE, ALASKA, WITH PROVISIONAL KEY,
Geological Survey, Menlo Park, CA. Water Resources Div.
L. J. Tilley.
The Pan-Pacific Entomologist, Vol. 54, No. 4, p 241-260, October 1978. 14 fig, 22 ref.

Descriptors: *Baseline studies, *Benthic fauna, *Aquatic insects, *Arctic, *Streams, Diptera, Entomology, Larvae, Midges, Systematics, Lotic environment, Alaska, *Brooks Range, *Dietrich River, *Atigun River, Diamesinae, Podonominae, Diamesa, Pseudokiefferiella, Syndiamesa, Trichotanypus.

Benthic invertebrate samples were collected in August 1971 before road and oil pipeline construction in the Brooks Range, Alaska. Drift nets, dip nets, and rock scrubbing procedures were used in sampling. Because little is known about species of aquatic Arctic insects, this report, in part, is intended to fill some of that void. All the samples taken were dominated by midge larvae (Chironomidae: Diptera). The subfamily Diamesinae was most conspicuous in samples taken at the headwaters of two river basins, the Dietrich River flowing south and the Atigun River flowing north. Eleven Diamesinae taxa, 9 Diamesa, 1 Pseudokiefferiella and 1 Syndiamesa, and a single Podonominae, Trichotanypus, were found. Principle morphological features of the larvae of each taxon are described and illustrated; and a key, based on 6 or 7 larval characteristics, is included. (Woodard-USGS)
W80-00218

CORROSION AND SCALE-FORMATION PROPERTIES OF GEOPRESSURED GEOTHERMAL WATERS FROM THE NORTHERN GULF OF MEXICO BASIN,
Geological Survey, Menlo Park, CA. Water Resources Div.
Y. K. Kharaka, P. M. Brown, and M. S. Lico.
Paper SPE 7866 presented at the International Symposium on Oilfield and Geothermal Chemistry held in Houston, Texas, January 22-24, 1979. Society of Petroleum Engineers of AIME, p 55-58, 1979. 1 fig, 2 tab, 20 ref.

Descriptors: *Geothermal studies, *Water chemistry, *Thermal water, *Corrosion, *Scaling, Chemical analysis, Connate water, Texas, Louisiana, Coasts, Oil field, *Geopressured waters.

Corrosion and scale-formation properties of geopressured geothermal waters are expected to be different from those of waters having similar chemical composition but produced from oil and gas wells. The differences result because (1) geopressured geothermal waters will be at much higher temperatures (generally > 120 C), (2) the volumes of water produced per well will be much higher, and (3) oil will be absent from these waters. Detailed chemical analyses of 120 formation-water samples from 25 oil and gas fields in coastal Texas and Louisiana show that the dissolved solids of water in the geopressured zones ranges from about 10,000 to 270,000 mg/L. Na and Cl generally constitute more than 90 percent of the total cations and anions, respectively. The high salinities, Cl concentrations, and temperatures increase the corrosivity of geopressured geothermal waters by facilitating dissolution of iron at anodic sites. The corrosivity of these waters, however, will probably be controlled by reactions at cathodic sites. Cathodic reactions apparently will be slow because of the almost complete absence of dissolved oxygen, absence of sulfate-reducing bacteria (high temperatures), and low variation of pH (about 6 to 8). Corrosion due to H2S will be minimal because the concentrations of H2S are less than 1 mg/L. Computing the states of reactions of these waters with respect to 165 minerals indicate that oxyhydroxides of iron, carbonates of Ca, Sr, and Ba, and sulfate of Ba may precipitate from the waters during production. (Woodard-USGS)
W80-00219

HYDROLOGIC RECONNAISSANCE OF WESTERN ARCTIC ALASKA, 1976 AND 1977,
Geological Survey, Anchorage, AK. Water Resources Div.
J. M. Childers, D. R. Kernodle, and R. M. Loeffler.
Geological Survey open-file report 79-699, 1979. 70 p, 32 fig, 6 tab, 14 ref.

Descriptors: *Hydrologic data, *Water resources, *Surface waters, *Springs, *Alaska, Arctic, Streamflow, Discharge(Water), Lakes, Physical properties, Chemical properties, Ice cover, Water levels, Specific conductivity, Water temperature, Dissolved oxygen, Turbidity, Color, Hardness(Water), Hydrogen ion concentration, Potassium, Sodium, Carbon dioxide, Sulfates, Chlorides, Fluorides, Silica, Invertebrates, Flood flow, Low flow, Baseline studies, *Oil and gas discoveries, *Western Arctic Alaska.

Reconnaissance water-resource investigations were conducted on the western Alaskan Arctic Slope during April 1976 and August 1977; these months are times of winter and summer low flow. The information gathered is important for coordinated development in the area. Such development has been spurred by oil and gas discoveries on the North Slope, most notably at Prudhoe Bay. Little water resources information is currently available. The study area extended from the Colville River to the vicinity of Kotzebue. It included the western Arctic Slope and the western foothills of the Brooks Range. Nine springs, nine lakes and eleven rivers were sampled during the April 1976 reconnaissance trip. Its purpose was to locate winter flow and describe its quantity and quality. Field water-quality measurements made at these sites were: ice thickness, water depth, discharge (spring and streams), specific conductance, water temperature, dissolved oxygen, alkalinity (bicarbonate, HOC3), and pH. A followup summer trip was made in August 1977 to determine flood characteristics of twenty selected streams. Bankfull and maximum evident flood-peak discharges were determined by measuring channel geometry and estimating channel roughness. Aquatic invertebrate samples were collected at springs and flood survey sites visited during both reconnaissance trips. (Woodard-USGS)
W80-00233

1B. Aqueous Solutions and Suspensions

AZOMETHINE H COLORIMETRIC METHOD FOR DETERMINING DISSOLVED BORON IN WATER,
Geological Survey, Denver, CO. Water Resources Div.
R. R. Spencer, and D. E. Erdmann.
Environmental Science and Technology, Vol. 13, No. 8, p 954-956, August 1979. 2 fig, 5 tab, 5 ref.

Descriptors: *Water analysis, *Chemical analysis, *Boron, *Analytical techniques, *Trace elements, Laboratory tests, *Azomethine H colorimetric method.

An automated colorimetric method for determining dissolved boron in water is described. The boron is complexed with azomethine H which is readily available as the condensation product of H-acid (8-amino-1-napthol-3,6-disulfonic acid) and salicylaldehyde. The absorbance of the yellow complex formed is then measured colorimetrically at 410 nm. Interference effects from other dissolved species are minimized by the addition of diethylenetriamine pentaacetic acid (DTPA); however iron, zinc, and bicarbonate interfere at concentrations above 400 micrograms per liter, 2,000 micrograms per liter, and 200 milligrams per liter, respectively. The bicarbonate interference can be eliminated by careful acidification of the sample with concentrated HCl to a pH between 5 and 6. Thirty samples per hour can be routinely analyzed over the range of from 10 to 400 micrograms per liter boron. (Woodard-USGS)
W80-00221

2. WATER CYCLE

2A. General

WATER RECOVERY DEVICE,
J. F. Clark.
U.S. Patent No. 4,148,617, 4 p, 1 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 2, p 571, April 10, 1979.

Descriptors: *Patents, *Meteoric water, *Water vapor, Condensation, Moisture, Equipment.

A device is disclosed for recovering water from ambient air. It has two chambers in one of which a pressurized air stream is heated and in the other of which another pressurized air stream is cooled after which the two air streams are mixed resulting in condensation of the moisture contained in the air streams which is then collected and put to use. (Sinha-OEIS)
W80-00030

ASSESSMENT OF WATER QUALITY SIMULATION CAPABILITY FOR LAKE ONTARIO,
Canada Centre for Inland Waters, Burlington (Ontario).
F. M. Boyce, A. S. Fraser, E. Halfon, D. Hyde, and D. C. L. Lam.
Scientific Series No. 111, 1979, 220 p, 66 fig, 55 tab, 110 ref.

Descriptors: *Water quality, *Model studies, *Seasonal, *Variability, *Analysis, Data collections, Sedimentation, Nutrients, Biochemistry, *Lake Ontario, *Spatial variations.

This report evaluates the ability of current water quality models to simulate seasonal variations, long-term trends, and spatial variations in Lake Ontario. The analysis relies on routine surveillance data collected during the last decade and especially on observations taken during the International Field Year on the Great Lakes (IFYGL). The model evaluations concentrate on conceptual frameworks rather than mathematical formulations. By fitting dynamic models to a seasonal database, it is shown that equally satisfactory simulations can be obtained by a variety of parameterizations and regardless of conditions of annual peri-

odicity. By comparison of model output with long-term observations, it is demonstrated that such seasonal verification studies are of little use in diagnosing the utility of these models for predicting long-term trends. It is concluded that the uncertainty surrounding the formulation of sedimentation and nutrient regeneration, as well as the sensitivity of models to assumptions regarding dynamic balance between lake concentrations and nutrient loadings, undermine the predictive capability of dynamic water quality models. With regard to spatial variations, it is concluded that the lakewide response can be simulated reasonably well by simplified horizontally mixed models but that three-dimensional models are necessary to simulate the very important differences in biochemical properties between nearshore and offshore zones. (WATDOC)
W80-00199

WATER QUALITY SOURCEBOOK. A GUIDE TO WATER QUALITY PARAMETERS,
Department of the Environment, Ottawa (Ontario). Water Quality Branch.
R. N. McNeely, V. P. Neimanis, and L. Dwyer.
1979, 89 p, 6 fig, 8 tab, 38 ref, 1 append.

Descriptors: *Water quality, *Water quality standards, *Parametric hydrology, *Metals, Alkalinity, Hardness(Water), Oxygen, Pesticides, Hydrogen ion concentration, Surfactants, Polychlorinated biphenyls, Temperature, Turbidity, Fish, Halides, Bacteria.

A broad spectrum of water quality parameters that are frequently encountered in the aquatic environment are discussed in general terms. Seventy parameters ranging from alkalinity to zinc are outlined under the following headings: (a) general information, (b) environmental range, (c) natural and man-made sources, (d) water quality guidelines, and (e) effects on use. A glossary is included to further explain the scientific terminology which is essential to the text. An appendix of 'Specific Use Guidelines' draws together and summarizes in a tabular form all the water quality guidelines presented in the test. The sources of the water quality guidelines are cited in the tables and are available in the references to the text. (WATDOC)
W80-00200

COMPARING WATER SUPPLY FORECAST TECHNIQUES,
Science and Education Administration, Boise, ID. Northwest Watershed Research Center.
J. F. Zuzel, and W. T. Ondrechen.
In: Watershed Management. Proceedings of A Symposium conducted by the Irrigation and Drainage Division of the American Society of Civil Engineers, Logan, Utah, August, 1975, p 327-336, 1975. 1 fig, 6 tab, 9 ref. ASCE, New York, NY.

Descriptors: *Water supply, *Forecasting, *Model studies, *Snowmelt, *Boise River(Idaho), Statistical methods, Regression analysis, Optimization, Runoff, Accuracy, Watersheds(Basins), Multiple-purpose reservoirs, Equations, Systems analysis.

Accurately forecasting the quantity of snowmelt runoff is a minimum operational requirement of any multipurpose reservoir system. All water supply forecast models provide volume information which often differ greatly. Examined herein are three of these models and a fourth model in an effort to arrive at a single 'best' forecast model for the Boise River in Idaho. The multiple regression models used by the Bureau of Reclamation, Corps of Engineers, and Soil Conservation Service to forecast runoff volume on the Boise River have several disadvantages, with reduced accuracy in early forecasts and in high and low runoff years being two of the most serious. The ARS-IDWR model somewhat overcomes many disadvantages associated with the multiple regression models; the method is versatile, easily applied, and a separate optimization can be performed for each forecast date. It is concluded that the daily streamflow model will not replace the long-term volume forecast model for some time to come.
W80-00202

MODELING MANAGEMENT OF PONDEROSA PINE FOREST RESOURCES,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, AZ.
M. B. Baker, Jr.
In: Watershed Management. Proceedings of a Symposium conducted by the Irrigation and Drainage Division of the American Society of Civil Engineers, Logan, Utah, August 1975. p 478-493, 1975. 9 fig, 4 tab, 7 ref. ASCE, New York, N.Y.

Descriptors: *Forest management, *Ponderosa pine trees, *Forest watersheds, *Water yield, *Effects, *Vegetation changes, Precipitation, Streamflow, *Treatment, Winter, Summer, Basal area, Arizona, Basins, Mathematical models, Regression analysis, Evaluation, Timber, Wildlife, Forage, Alternative planning, Economic analysis, Volcanic soils, Systems analysis.

In the middle 1950's, water users and ranchers urged the treatment of watersheds in Arizona's Salt-Verde Basin to increase water yields for irrigation and to provide more grass for grazing. In response, the Forest Service initiated watershed management studies to evaluate the effects of vegetation changes on water yield, soil, forage, wildlife and recreation. This paper reports on a study of the Beaver Creek Watershed during 1957 to 1962. The focus is on water yield; however timber, wildlife and forage are also considered. The article discusses: (1) treatment tests, including the distribution of precipitation and streamflow; (2) water responses, including the effects of treatments on winter streamflow in inches from pine watersheds, a preliminary water yield model, and summer sediment yield predicted by regression analysis; (3) responses of other resources; (4) evaluating planning and management alternatives; and finally (5) an economic evaluation of the ponderosa pine zone of the Salt-Verde River basin. Five principle conclusions are drawn concerning resource responses resulting from manipulating ponderosa pine forests on volcanic soils. (Bell-Graf--Cornell)
W80-00228

TWO-DIMENSIONAL AND THREE-DIMENSIONAL DIGITAL FLOW MODELS FOR THE SALINAS VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
T. J. Durbin, G. W. Kapple, and J. R. Freckleton.
Geological Survey Water-Resources Investigations 78-113, November 1978. 134 p, 70 fig, 14 tab, 78 ref.

Descriptors: *Groundwater basins, *Groundwater movement, *Model studies, *Mathematical models, *Dimensional analysis, Surface-groundwater relationships, Rainfall-runoff relationships, Hydrogeology, Water level fluctuations, Withdrawal, Groundwater recharge, Aquifer characteristics, Maps, *Salinas Valley(CA).

The Salinas Valley ground-water basin is in central coastal California. The ground-water basin extends from Monterey Bay southeastward along the Salinas River to San Ardo, a distance of about 70 miles, and has a maximum thickness of about 2,000 feet. Annual recharge to the ground-water basin, which is derived mostly from the Salinas River, is about 290,000 acre-feet. Annual discharge, which is mostly from pumpage but also includes the consumptive use of ground water by riparian vegetation along the Salinas River, is about 507,000 acre-feet. About 45 percent of the pumpage, or about 217,000 acre-feet of water annually, returns to the ground-water system. A system of interacting hydrologic models was developed for the Salinas Valley. These models include the small-stream model, river model, two-dimensional ground-water model, and three-dimensional ground-water model. The small-stream model simulates ground-water recharge from small streams that are tributary to the Salinas River. The river model simulates ground-water recharge from the surface-water discharge in the Salinas River. The two-dimensional and three-dimensional ground-water models simulate hydraulic head in the ground-water basin. (Woodard-USGS)
W80-00238

CONTRIBUTION OF URBAN RUNOFF TO HYDROCARBON POLLUTION,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W80-00357

2B. Precipitation

POLYCHLORINATED BIPHENYLS AND ORGANOCHLORINE PESTICIDES IN GREAT LAKES PRECIPITATION,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W80-00086

SYSTEMATIC SAMPLING OF GAUSSIAN RANDOM PROCESSES AND FIELDS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W80-00089

A STOCHASTIC KINEMATIC STUDY OF SUBSYNOPTIC SPACE-TIME RAINFALL,
Mississippi Univ., University. Dept. of Civil Engineering.
V. K. Gupta, and E. C. Waymire.
Water Resources Research, Vol. 15, No. 3, p 637-644, June 1979. 1 fig, 20 ref. NSF ENG76-08998, ENG78-05147.

Descriptors: *Rainfall, *Spatial distribution, *Temporal distribution, *Model studies, Mathematical models, Precipitation(Atmospheric), Rainfall intensity, Mathematics, Equations, Stochastic processes, Analytical techniques, Meteorology.

A kinematic stochastic approach to quantify the ground rainfall intensity field due to the passage of a large mesoscale area (LMSA) was presented. The theoretical developments were based on 4 postulates on the components of an LMSA. The 4 postulates incorporate the spatial clustering that the rainfall cells have been observed to exhibit. These postulates lead to a representation of the rainfall field as a stochastic integral. An analysis of the structure of this integral revealed two auxiliary stochastic fields embedded within it. Not only do each of these admit an independent physical interpretation, but their analysis is a precursor to the analysis of the space-time rainfall field. Some results on the space-time dependence structure of the auxiliary fields were presented. As an application of these results, expressions were derived for the mean, variance, and the one-dimensional characteristic function of rainfall intensity. A part of the mathematical construct also provided algorithms which can be used for simulating space-time rainfall. (Sims-ISWS)
W80-00092

SUBSTRATE CONDITIONS, COMMUNITY STRUCTURE AND SUCCESSION IN A PORTION OF THE FLOODPLAIN OF WISSAHICKON CREEK,
S. C. Sollers.
Bartonia, No. 42, p 24-42, 1973-1974. 4 fig, 3 tab, 17 ref.

Descriptors: *Soil types, *Soil water movement, *Floodplains, *Allogenic succession, *Autogenic succession, *Biological communities, Hydrogen ion concentration, Nutrients.

Interrelationships among substrate conditions, community structure, and succession in Wissahickon Creek floodplain of Pennsylvania were analyzed. Nutrient concentrations are moderate in shallow, moderately well-drained soils and deficient in deep, well-drained soils. Silt loam is found in swamp white oak, oak-hickory, ash-walnut, and oak-beech communities; loamy soils in sycamore, yellow poplar and locust-maple communities; and

sandy loams in white pine. Norway maple prefers moisture and potassium. Slippery elm favors sites with rich alkaline soils high in organic matter. Shellbark hickory prefers rich soils, and is tolerant of hydrogen ion concentration variations. Red maple favors bottomland soils with a high water table. Northern red oak prefers moist, slightly acidic conditions, and tolerates low nutrient conditions. American beech favors well-drained loam soils. White oak tolerates nutritionally poor soils of oak-beech but does better in richer oak-hickory. Flowering dogwood tolerates poor soils; sycamore favors well-drained, enriched soils; yellow poplar alkaline, high nutrient soils. White ash success is independent of organic matter. Blackhaw indicates slightly acidic, rich soils. A change in soil conditions has a greater effect on seedlings than mature specimens. Physical factors controlled by the stream dominate the initial stages of succession, with biotic factors dominating later. (Otello-Mass)
W80-00310

BIOGEOCHEMISTRY OF A FORESTED ECOSYSTEM,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
For primary bibliographic entry see Field 4C.
W80-00328

RAINFALL MEASUREMENT BY RADAR,
British Meteorological Office, Bracknell (England).
For primary bibliographic entry see Field 7B.
W80-00329

A SYSTEM FOR REAL-TIME PROCESSING TRANSMISSION AND DISPLAY OF RADAR-DERIVED RAINFALL DATA,
Royal Radar Establishment, Malvern (England).
For primary bibliographic entry see Field 7B.
W80-00330

DESIGN OF THE DEE TELEMETRY SYSTEM WITH COMPUTER ACQUISITION OF DATA,
Water Resources Board, Reading (England).
For primary bibliographic entry see Field 7B.
W80-00331

INSTALLATION AND OPERATION OF THE DEE TELEMETRY SYSTEM,
Welsh National Water Development Authority, Cardiff (Wales).
For primary bibliographic entry see Field 7B.
W80-00332

CAPITAL AND OPERATING COSTS OF THE EXISTING DEE RADAR, TELEMETRY AND FLOW FORECASTING PROJECT,
Water Resources Board, Reading (England).
For primary bibliographic entry see Field 7B.
W80-00333

RAINFALL FORECASTS IN THE UNITED KINGDOM USING RADAR DATA,
British Meteorological Office, Bracknell (England).
T. W. Harrold.
Paper 8, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 21 p, 7 fig, 1 tab, 12 ref.

Descriptors: *Rainfall, *Forecasting, *Radar, Precipitation(Atmospheric), Mathematical models, Data processing, Remote sensing, Watersheds(Basins), Weather, Climatology, Meteorology, *England, *Wales, *River Dee.

Weather radars are used in the United Kingdom for both operational and research purposes. The operational radars indicate rainfall distribution, but they are not capable of making quantitative rainfall measurements. Data from the research radars were used in this paper to demonstrate that much more ambitious forecasts could be attempted if there were a network of radars capable of quantitative measurement covering the country. (Sims-ISWS)
W80-00336

OPERATIONAL USE OF DIGITAL RADAR IN RAINFALL MEASUREMENT AND PREDICTION,
National Weather Service, Silver Spring, MD. Office of Hydrology.
For primary bibliographic entry see Field 7B.
W80-00337

FIELD PROJECTS EXECUTED BY WMO ON FLOOD FORECASTING AND WARNING, USING RADAR AND/OR INTEGRATED TELEMETRY SYSTEMS.
World Meteorological Organization, Geneva (Switzerland).
For primary bibliographic entry see Field 2E.
W80-00338

EFFECTS OF ACIDIC PRECIPITATION ON PRECAMBRIAN FRESHWATERS IN SOUTHERN ONTARIO,
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
For primary bibliographic entry see Field 5A.
W80-00344

SURFACE LOADING FROM POLLUTANTS IN PRECIPITATION IN SOUTHERN ONTARIO: SOME CLIMATIC AND STATISTICAL ASPECTS,
Windsor Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 5A.
W80-00345

RIDGE REGRESSION--TIME EXTRAPOLATION APPLIED TO HAWAIIAN RAINFALL NORMALS,
Hawaii Univ., Honolulu. Joint Inst. for Marine and Atmospheric Research.
B. N. Meisner.
Journal of Applied Meteorology, Vol. 18, No. 7, p 904-912, July 1979. 2 fig, 3 tab, 43 ref, 1 append. NOAA 03-7-028-31000.

Descriptors: *Rainfall, *Data processing, *Analytical techniques, *Hawaii, Regression analysis, Meteorological data, Climatic data, Data processing, Mathematics, Statistics, Mapping, Climatology, *Oahu(HI), Ridge regression.

In this paper, ridge regression was introduced as a technique for extrapolating long-period normal rainfalls from short records. The data used were the annual totals for selected stations on the island of Oahu, Hawaii. It was shown that when the predictor variables are not mutually independent, as is often the case in meteorology, it is unlikely that the estimates of the coefficients obtained through unbiased multiple linear regression will be close to the correct values. In such cases, a method of biased estimation, such as the so-called ridge regression, will yield more accurate estimates of the true regression coefficients. Ridge regression was shown to be superior to ordinary least-squares regression and double-mass analysis, and was a robust estimator of central tendency for extrapolating Hawaiian rainfall normals. Mention was also made on the choice of normal statistic and on the selection of the base period of record. Since there is such a diversity of both topographic and climatological regions on Oahu Island, it is expected that this method should be applicable in many other locales. Furthermore, the method is not limited to rainfall data; statistical relationships among other meteorological variables, such as model output statistics, may be similarly determined using this technique. (Sims-ISWS)
W80-00350

ACIDIFICATION OF HEADWATER STREAMS IN THE NEW JERSEY PINE BARRENS,
Pennsylvania Univ., Philadelphia. Dept. of Landscape Architecture.
For primary bibliographic entry see Field 5B.
W80-00354

2C. Snow, Ice, and Frost

EFFECT OF THE PERCENTAGE AND DISTRIBUTION OF FORESTED AREAS ON SNOWMELT RUNOFF (EFFET DU POURCENTAGE ET DE LA DISTRIBUTION DES SURFACES BOISEES SUR LES CRUES DE FONTE DE NEIGE),
National Inst. of Scientific Research (Quebec).
R. Charbonneau, G. Morin, and J. P. Fortin.
Journal of Hydrology, Vol. 41, No. 1/2, p 93-103, April 1979. 3 fig, 1 tab, 27 ref.

Descriptors: *Model studies, *Forest management, *Water yield, *Simulation analysis, *Snowmelt, Runoff, Mathematical models, River basins, Hydrology, Floods, *Deforestation, *Kenogami watershed, Redistribution.

A mathematical model was developed to simulate the effect of a variation in forest cover on snowmelt runoff. The variation can be in the percentage of forested area as well as in the distribution of these areas. The simulations can provide important data for basin management. The model was applied to basins exceeding 3,000 sq km, and the results clearly indicated the possibility of modifying the snowmelt synchronization between different parts of a basin by changing the distribution and/or percentage of its forest cover. (Singh-ISWS)
W80-00072

DIRECT OBSERVATIONS OF AEROSOLS ATTACHED TO FALLING SNOW CRYSTALS,
Hokkaido Univ., Sapporo (Japan). Dept. of Geophysics.
C. Magono, T. Endoh, F. Ueno, S. Kubota, and M. Itasaka.
Tellus, Vol. 31, No. 2, p 102-114, April 1979. 6 fig, 1 tab, 15 ref.

Descriptors: *Snow, *Aerosols, *Fallout, *Water pollution sources, Sampling, Analytical techniques, Analysis, Crystals, Testing procedures, Instrumentation, Foreign research, Microscopy, Size, Distribution, On-site investigations, *Japan.

Aerosols attached to falling snow crystals were directly observed utilizing optical and electron microscopes in Sapporo, Japan, in March 1973 and 1974. It was determined that the aerosols were picked up by snow crystals during their fall under the cloud base. Because the slope of size distribution of aerosols attached to snow crystals was nearly the same as Junge distribution in the range 0.1 to 5 microns, it was considered that falling snow crystals captured aerosols with a collection efficiency almost similar to neighboring size ranges against the general theory of collection efficiency. The collection efficiency was also calculated by the use of surface density of aerosols attached to the surface of snow crystals. The results of calculations showed that the apparent collection efficiency was as high as near unity. In order to explain such high efficiency, many possible mechanisms, e.g., impact collision, Facy effect, diffusion (Brownian motion and turbulent motion), and electrostatic force were theoretically estimated. However, these mechanisms were insufficient to explain the high collective efficiency. This suggests that there are some unknown mechanisms remaining in the natural washout of aerosols by falling snow crystals. (Humphreys-ISWS)
W80-00080

A DYNAMIC THERMODYNAMIC SEA ICE MODEL,
Army Terrestrial Sciences Center, Hanover, NH.
W. D. Hibler, III.
Journal of Physical Oceanography, Vol. 9, No. 4, p 815-846, July 1979. 26 fig, 4 tab, 52 ref, 3 append. NOAA 64-7-022-44017.

Descriptors: *Sea ice, *Oceans, *Arctic, *Model studies, Mathematical models, Ice, Ice cover, Circulation, Ocean circulation, Freezing, Growth rates, Velocity, Movement, Stress, Viscosity, Oceanography, Cold regions, Ice thickness.

A numerical model for the simulation of sea ice circulation and thickness over a seasonal cycle was presented. This model was used to investigate the effects of ice dynamics on Arctic ice thickness and air-sea heat flux characteristics by carrying out several numerical simulations over the entire Arctic Ocean region. The essential idea in the model was to couple the dynamics to the ice thickness characteristics by allowing the ice interaction to become stronger as the ice becomes thicker and/or contains a lower areal percentage of thin ice. The dynamics, in turn, causes high oceanic heat losses in regions of ice divergence and reduced heat losses in regions of convergence. To model these effects consistently, the ice was considered to interact in a plastic manner with the plastic strength chosen to depend on the ice thickness and concentration. The thickness and concentration, in turn, evolve according to continuity equations which include changes in ice mass and percent of open water due to advection, ice deformation, and thermodynamic effects. For the standard experiment, an integration of 8 years in length was performed at one day timesteps and 125 km resolution in order to obtain a cyclic equilibrium. A zero ice strength condition was used at the Greenland-Spitsbergen passage to allow natural outflow or inflow. Several other shorter experiments, including a case without open water effects, were also run for comparison. Input fields consist of observed time varying geostrophic winds over a one year period, fixed geostrophic ocean currents, and geographically invariant ice growth rates dependent on ice thickness and season. (Sims-ISWS)
W80-00084

SOLAR RADIATION AS INDEXED BY CLOUDS FOR SNOWMELT MODELING,
Arizona Univ., Tucson. School of Renewable Natural Resources.
D. P. McAda, and P. F. Ffolliott.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Arizona, p 175-181, 3 fig, 9 ref.

Descriptors: *Snowmelt, *Snow management, *Cloud physics, *Regression analysis, *Solar radiation, Melt water, Cloud cover, Atmospheric physics, Model studies, Forecasting, Hydrologic equation, Arizona.

In an effort to improve the methods of forecasting the amount and timing of snowmelt, a primary source of water in Arizona, significant regression equations are developed over a selected measurement period to relate global, direct, and diffuse solar radiation to: (1) the cloud-cover of specific cloud genera, (2) the hour before or after solar noon, and (3) the potential solar radiation. Three regression equations are derived from cloud-cover imagery and solar radiation data collected from two sites in Arizona's Ponderosa pine forests, Schnebly Hill, and Alpine, in the hope that regression models will be useful in the simulation of snowpack dynamics. (Tickes-Arizona)
W80-00292

2D. Evaporation and Transpiration

THE PRIESTLEY-TAYLOR EVAPORATION MODEL APPLIED TO A LARGE, SHALLOW LAKE IN THE NETHERLANDS,
Royal Netherlands Meteorological Inst., De Bilt.
H. A. R. de Bruin, and J. Q. Keijman.
Journal of Applied Meteorology, Vol. 18, No. 7, p 898-903, July 1979. 5 fig, 1 tab, 16 ref.

Descriptors: *Evaporation, *Lakes, *Shallow water, *Model studies, Mathematical models, Saturated soils, Drying, Energy budget, Diurnal, Wind, Temperature, Heat flow, On-site investigations, On-site data collections, Meteorological data, *The Netherlands, *Lake Flevo(The Netherlands).

The applicability of the model of Priestley and Taylor for evaporation of saturated surfaces was examined for the former Lake Flevo (The Netherlands). This lake had an area of about 460 sq km and an average depth of 3 m. Daily values of evaporation in the period July-September 1967, determined with the energy-budget method, were compared with the corresponding estimated values obtained by the Priestley-Taylor model. The agreement appeared to be satisfactory. The diurnal variation of the parameter alpha of the Priestley-Taylor model was found to be pronounced. From standard meteorological observations at Oostvaardersdiep, a station at the perimeter of the lake, and an energy-budget model of Keijman, an indirect extension of the available time series was obtained. In this way, energy-budget data for the period April-October 1967 became available. Analysis of this data set led to the preliminary conclusion that alpha has a seasonal variation. This was due to the fact that there is a linear relation between the daily latent heat flux LE and the equilibrium latent heat flux LE sub EQ with a nonzero intercept. (Sims-ISWS)
W80-00349

HEAT TRANSFER THROUGH THE THERMAL SKIN OF A COOLING POND WITH WAVES,
Argonne National Lab., IL.
M. L. Wesely
Journal of Geophysical Research, Vol. 84, No. C7, p 3696-3700, July 20, 1979. 3 fig, 1 tab, 22 ref.

Descriptors: *Heat transfer, *Thermal properties, *Cooling, Thermal water, Waves(Water), Latent heat, Cooling water, Temperature, Wind velocity, Wind, *Thermal skin, *Cooling pond, Temperature drop, Surface temperature, Total heat transfer, Sensible heat flux, Long-wave radiation exchange.

The temperature drop measured across the cool skin of a cooling pond was examined for 64 10-minute data collection periods taken with wind speeds of 3-8.5 m/s (effectively at a height of 10 m) and surface temperatures of 18-37.5 C. The total heat transfer through the skin was found with the use of bulk aerodynamic estimates of the latent and sensible heat flux densities and empirical expressions for the long-wave radiation exchange at the surface. Although it is questionable to describe the characteristics of a surface with waves by the use of formulas derived partially on the assumption that a rigid boundary exists at the air-water interface, the parameterizations that result seem to perform quite well. For example, values of the numerical proportionality coefficient which relate the total heat transfer to the temperature drop increase slightly from 6 to 7 as water temperature increases; these values are near those reported previously. No variation of proportionality coefficient with wind speed was detected. If the proportionality coefficient is replaced by a numerical coefficient that also takes into account the difference of the thickness of the thermal and viscous sublayers, the new coefficient does not vary significantly with temperature of the surface skin. (Roberts-ISWS)
W80-00351

2E. Streamflow and Runoff

STREAM CHANNEL MODIFICATION IN HAWAII. PART A: STATEWIDE INVENTORY OF STREAMS: HABITAT FACTORS AND ASSOCIATED BIOTA,
Hawaii Cooperative Fishery Research Unit, Honolulu.
For primary bibliographic entry see Field 6G.
W80-00003

STREAM CHANNEL MODIFICATION IN HAWAII. PART B: EFFECT OF CHANNELIZATION ON THE DISTRIBUTION AND ABUNDANCE OF FAUNA IN SELECTED STREAMS,
Hawaii Cooperative Fishery Research Unit, Honolulu.
For primary bibliographic entry see Field 6G.
W80-00004

THE FLUVIAL SYSTEM: SELECTED OBSERVATIONS,
California Univ., Santa Barbara. Dept. of Geological Sciences.
E. A. Keller.
In: Riparian Forests in California: Their Ecology and Conservation, Anne Sands, editor, Institute of Ecology, University of California, Davis, Publication No. 15, May, 1977, p 39-46. 7 fig, 15 ref.

Descriptors: *Streams, *Channels, *Sediments, Effects, Erosion, Deposition(Sediments), Meanders, Gravels, Floodplains, Hydrology, Flow.

Significant changes in the fluvial system often occur when a geomorphic or hydraulic threshold is exceeded. These changes are partly responsible for maintaining the dynamic equilibrium state of the stream system. Human use and interest in the fluvial environment has led to human interference with the fluvial system. The interference generally reduces channel, floodplain and hydraulic variability and thus the biological variability. The behavior of natural streams is not completely understood. Particularly important is the need to know more about relationships between erosion, deposition and sediment concentration, as well as the effect of organic debris on stream channel morphology. (Stihler-Mass)
W80-00019

FLORISTICS OF THE MIDDLE MISSISSIPPI RIVER SAND AND MUD FLATS,
Marshall Univ., Huntington, WV. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2I.
W80-00028

EMERGENT AQUATIC PLANTS IN THE UPPER OHIO RIVER AND MAJOR NAVIGABLE TRIBUTARIES, WEST VIRGINIA AND PENNSYLVANIA,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2I.
W80-00029

VELOCITY PROFILES AND MINIMUM STREAM POWER,
Minnesota Univ., Minneapolis. Dept. of Civil Engineering.
C. C. S. Song, and C. T. Yang.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY8, Proceedings Paper 14780, p 981-998, August 1979. 8 fig, 27 ref, 2 append.

Descriptors: *Viscosity, *Velocity, *Streams, Open channels, Open channel flow, Turbulence, Turbulent boundary layer, Flow, Equations, Energy dissipation, Eddies, Reynolds number, Stream power, Velocity distribution.

The velocity distribution of laminar and turbulent flows in a wide open channel was analyzed using the theory of minimum rate of energy expenditure or, equivalently, the theory of minimum stream power. The solution for the laminar flow is the classical parabolic velocity distribution. For turbulent flow it is necessary to assume the functional forms of the velocity distribution and the corresponding eddy viscosity distribution. A number of constants or parameters in the assumed functions were determined using the minimization theory and appropriate constraint equations. By assuming that the turbulent flow may consist of a logarithmic inner layer and a parabolic outer layer, the minimization theory determines that the thicknesses of the two layers must be equal. Two constants remain to be determined using experimental data. It was suggested that the two empirical constants are best determined by measured maximum and mean velocities. Theoretical results were verified with data available in the literature. (Lee-ISWS)
W80-00077

FLOOD PROFILES OF THE PITHLACHASCOTEE RIVER, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. F. Turner, Jr., W. R. Murphy, Jr., and C. V.

Reeter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 107, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-100, 1979. 22 p, 5 fig, 4 tab, 19 ref.

Descriptors: *Flood profiles, *Flood plains, *Peak discharge, *Flood flow, *Flood recurrence interval, Methodology, Hydrologic data, Flood plain zoning, Watersheds(Basins), Drainage area, Physical properties, Geology, Topography, Karst, Florida, *Pithlachascotee River, *Pasco County(Fla).

Data defining the magnitude and frequency of flooding are provided for a nontidal 16-mile reach of the Pithlachascotee River in Florida. These data include areal flood-frequency relations and flood heights for the 2-, 2.33-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year recurrence intervals. Flood profiles are provided for the 2.33-, 5-, 10-, 100-, and 500-year recurrence intervals. Study results indicate that flood discharges in the study area are highly variable and are one-third to one-half of regional estimates. Differences between study area and regional estimates are due to large quantities of flood-water drainage to the regional aquifer system in the upper basin, a large karst area of about 138 square miles. Graded roads and bridges located at three sites along the upper study reach will be inundated by various frequency floods. Flood inundation maps can be prepared from flood data presented in this report. (Woodard-USGS)
W80-00225

BACKWATER AT BRIDGES AND DENSELY WOODED FLOOD PLAINS, TALLAHALA CREEK AT WALDRUP, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.; and Geological Survey, Montgomery, AL. Water Resources Div.; and Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-00241

EFFECTS OF RAINFALL INTENSITY ON RUNOFF CURVE NUMBERS,
Utah State Univ., Logan. Watershed Science Unit.
R. H. Hawkins.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Arizona, p 53-64, 7 fig, 1 tab, 11 ref.

Descriptors: *Rainfall-runoff relationships, *Storm runoff, *Runoff coefficient, *Curves, *Rainfall intensity, *Infiltration, Forecasting, Hydrologic equation, Measurement, Design criteria.

The runoff curve number method developed by the SCS to calculate 'direct storm runoff', is analyzed here in terms of its appropriate usage, possible adjustments, augmentation or replacement. It is concluded that associating intensity and infiltration with curve numbers could lead to greater utilization of existing field measurements of infiltration. Accordingly, a rainfall partitioning approach is developed for application either as a guide in the selection of curve number in a design application with the choice depending upon the intensity distribution of the storm at hand compared to the CN distribution or where conditions merit, as an alternative to the curve number method. The two methods are compared while pointing out the assumption and limitations in application of both. (Tickes-Arizona)
W80-00276

EPHEMERAL FLOW AND WATER QUALITY PROBLEMS: A CASE STUDY OF THE SAN PEDRO RIVER IN SOUTHEASTERN ARIZ.,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
S. J. Keith.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Az. p 97-100, 1 tab, 5 ref.

Descriptors: *Ephemeral streams, *Water sources, *Water quality, Non-perennial streams, Floods, Environmental effects, Basins, Planning, Comprehensive planning, Arizona, San Pedro River, Storm runoff, International waters, Water pollution sources.

Discontinuous water quality data for the San Pedro River in southeastern Arizona is analyzed to illustrate the nature of water quality problems of ephemeral flow. The San Pedro drains a northerly-trending basin of 4,483 square miles, of which 696 are in Mexico and 3,787 in Arizona. Several questions arise in the consideration of a rational management plan: what is the necessity for protection of ephemeral flow quality when the channel consists of a dry wash much of the year, where there is little aquatic or wildlife to protect, and where occasional flow during flood conditions is put to little use by humans; and where and how do we use the ephemeral flow it is indeed decided to utilize it. Such questions as these form the basis of this discussion in an effort to bring out the point that water quality problems of ephemeral flow in arid areas differ from those in the humid zone. It is argued that in between the extremes of prohibiting or treating all runoff or eliminating all sources of pollution, there is actually little that can be done to control all sources of pollution in this typical arid stream, despite the fact that standards, for the most part unattainable, have been set for this flow. (Tickes-Arizona)
W80-00281

INTERFACIAL STABILITY IN CHANNEL FLOW,
Vanderbilt Univ., Nashville, TN. Dept. of Environmental and Water Resources.
R. H. French.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY8, Proceedings Paper 14768, p 955-967, August 1979. 4 fig, 2 tab, 17 ref, 2 append. OWRT A-044-TENN(2). 14-34-0001-7089, 14-34-0001-7090.

Descriptors: *Open channel flow, *Open channels, *Density current, Mudflows, Density stratification, Interfaces, Turbulence, Hydraulics, Stability, *Interfacial stability, Richardson number.

Interfacial stability in the special case of superposed turbulent layers with a zero velocity difference at the interface was examined. In contrast with previous investigations in which the primary mechanism of turbulence generation was interfacial shear, the primary source of turbulence was bottom boundary shear. Interfacial stability was defined in terms of two dimensionless parameters: the Keulegan number and a Richardson number based on the shear velocity and the maximum change in density across the flow. Laboratory flume data and field data taken downstream of thermal power plants on several rivers confirmed the hypothesis. (Lee-ISWS)
W80-00297

WEED CONTROL METHODS FOR RIVER BASIN MANAGEMENT,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 2I.
W80-00323

REAL-TIME CONVERSION OF RAINFALL TO RUNOFF FOR FLOW FORECASTING IN THE RIVER DEE,
Institute of Hydrology, Wallingford (England).
M. J. Lowing, R. K. Price, and R. A. Harvey.
Paper 6, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 22 p, 9 fig, 3 tab, 14 ref.

Descriptors: *Rainfall, *Runoff, *Forecasting, *Mathematical models, Model studies, Rivers, Flow, Streamflow, Hydrographs, Radar, Rain gages, Telemetry, Reservoirs, Reservoir operation, Watersheds(Basins), Hydrology, *England, *Wales, *River Dee.

This paper described the model for converting recorded or estimated rainfall and forecast rainfall into flow hydrographs at various sites on the River Dee. The subcatchment routing and channel routing aspects were treated separately and the operational use of the combined model was discussed. It was suggested that, while the experience of producing and implementing a real-time forecasting system must be widely beneficial, the particular techniques used on the Dee may not be applicable elsewhere. (Sims-ISWS)
W80-00334

CONTROL RULES FOR LONG AND SHORT TERM OBJECTIVES,
Welsh National Water Development Authority, Chester (England).
A. O. Lambert, and R. J. Cameron.
Paper 7, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 23 p, 4 fig, 2 tab, 31 ref.

Descriptors: *Flood control, *Flow control, *Reservoir operation, Rivers, Reservoirs, Lakes, Water levels, Streamflow, Storage, Runoff, Floods, Planning, Hydrographs, Hydrology, *England, *Wales, *River Dee.

The paper had two purposes, to review general techniques for deriving control rules for river regulating reservoirs, and to describe control rules for the River Dee system. Control rules proposed as part of the Dee research program were compared with the current operational rules of the Welsh National Water Development Authority to illustrate examples of the difference in control rules derived from different points of view. (Sims-ISWS)
W80-00335

FIELD PROJECTS EXECUTED BY WMO ON FLOOD FORECASTING AND WARNING, USING RADAR AND/OR INTEGRATED TELEMETRY SYSTEMS.
World Meteorological Organization, Geneva (Switzerland).
Paper 10, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 18 p, 5 fig.

Descriptors: *Floods, *Flood forecasting, *On-site investigations, Radar, Telemetry, Rain gages, Remote sensing, Projects, Rainfall, Precipitation(Atmospheric), Runoff, Forecasting, Meteorological data, Weather data, Meteorology, Hydrology.

In addition to the regular program activities in hydrology and water resources, the World Meteorological Organization (WMO) is also involved in technical cooperation field projects. The regular program activities are carried out within the Operational Hydrology Programme (OHP), mainly through the WMO Technical Commission for Hydrology, in close collaboration with the other WMO commissions. Hydrological forecasting is one of the substantive activities of the regular program and is included in the specific priority activities within the OHP for the period 1975 to 1980. The ongoing activities on hydrological forecasting include the preparation of guidance material on forecasting of ice formation and ice break-up, forecasting of low flows and related aspects of droughts, cost/benefit relationship of hydrological forecasts, influence of infiltration on forecasts of runoff, use of World Weather Watch systems for hydrological forecasting and forecasting of floods resulting from tropical cyclone rainfall. Most of the main field projects in hydrology are those on flood forecasting and warning, some have been successfully completed, and still many others are being executed. This paper described briefly 8 typical projects in this field. (Sims-ISWS)
W80-00338

A TELEMETRY SYSTEM WORKING THROUGH THE PUBLIC TELEPHONE NETWORK,

Louvain Univ. (Belgium).
E. Persoons, G. Bazier, S. Musch, and J. C. Rouvet.
Paper 11, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 10 p, 4 fig, 7 ref.

Descriptors: *Flood control, *Flood forecasting, *Telemetry, *Data transmission, Rivers, Rainfall, Precipitation(Atmospheric), Rain gages, Water levels, Flow, Flow control, Equipment, Instrumentation, Networks, Hydrology, Floods, Telephone networks.

These last years hydrologists are very interested in applying their studies to river flow forecasting. With the help of the mathematical theories of models and the increasing possibilities of fast treatment of the information, it is possible to construct hydrological models and to apply them in real time to forecast river flow. A direct utility of forecasting is flood regulation by, for example, diverting a part of the river flow into storm basins or by the maneuvering of weir gates. After a short description of the river studied, a system of measurement and treatment of the data was presented. The flexibility of use of the automatic telemeasurement system, controlled by mini-computer, helps in adopting programs of flow forecasting which will allow for an optimal command of the flow regulation devices. (Sims-ISWS)
W80-00339

REAL-TIME FLOOD FORECASTING FOR SOUTHERN CALIFORNIA,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
G. Fleming, and K. M. Leytham.
Paper 12, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 12 p, 3 fig, 4 tab, 3 ref.

Descriptors: *Flood forecasting, *Flood control, *Mathematical models, *California, Rivers, Flow, Riverflow, Streamflow, Floods, Rainfall, Precipitation(Atmospheric), Forecasting, Computers, Computer programs, Model studies, Hydrology, *Santa Ynez River(CA).

This paper examined the use of simulation techniques for real-time flow forecasting and considered the implications of using various forms of measured and forecast rainfall input. The Santa Ynez River in Southern California was considered as an example, and results were presented to demonstrate the benefits of using simulation techniques with both telemetered rainfall and quantitative precipitation forecasts as input. (Sims-ISWS)
W80-00340

RELATIVE ACCURACY OF CONNECTING CHANNEL DISCHARGE DATA WITH APPLICATION TO GREAT LAKES STUDIES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
F. H. Quinn.
Journal of Great Lakes Research, Vol. 5, No. 1, p 73-77, 1979. 2 fig, 2 tab, 6 ref.

Descriptors: *Great Lakes, *Discharge(Water), *Flow, Measurement, Current meters, Data analysis, Channels, Rivers, River flow, Analytical techniques, Water balance, Lakes, Limnology, Hydrology, Connecting channels, Flow measurement.

The flows in the Great Lakes connecting channels are a major component in the water balance of the Great Lakes Basin. The increased emphasis on Great Lakes water quality and quantity requires an assessment of the accuracy of both measured and computed connecting channel discharge data. In this study, the standard error of typical discharge measurements was found to be approximately 3 to 5%, depending upon the number of panels used in the cross section. Measurement sets were found to have a practical limit of about 25 measurements. The standard error of a set of measurements was found to be on the order of 1%. The procedure used to compute the published flows of the Niagara River was found to have an apparent bias of about 2% on the high side. It was recommended that the published Niagara River flows be adjusted prior to use in detailed water balance studies. (Sims-ISWS)
W80-00347

2F. Groundwater

STOCHASTIC ANALYSIS OF STEADY STATE GROUNDWATER FLOW IN A BOUNDED DOMAIN 1. ONE-DIMENSIONAL SIMULATIONS,
British Columbia Univ., Vancouver. Dept. of Geological Sciences.
L. Smith, and R. A. Freeze.
Water Resources Research, Vol. 15, No. 3, p 521-528, June 1979. 10 fig, 13 ref.

Descriptors: *Monte Carlo method, *Groundwater movement, *Steady flow, *Model studies, Stochastic processes, Statistical models, Hydraulic conductivity, Homogeneity, Correlation analysis, Boundaries(Surfaces), Artesian heads, Water levels, Nearest-neighbor stochastic process model, Hydraulic head, Standard deviation, One-dimensional model.

A stochastic analysis of one-dimensional, steady-state groundwater flow through a bounded domain was carried out by using Monte Carlo simulation techniques. The flow domain was divided into a finite set of discrete blocks. Hydraulic conductivity values in neighboring blocks were autocorrelated by assuming that the spatial variations in conductivity can be represented by a first-order, nearest neighbor, stochastic process model. An integral scale was defined to characterize the average distance over which conductivity values in the block system are autocorrelated. This model leads to a realistic representation of the spatial variations in hydraulic conductivity in a discrete block medium. Results of the simulations provided estimates of the output distributions in hydraulic head. It was shown that the ratio of the integral scale for conductivity to the distance between boundary points is a fundamental parameter in modeling the stochastic behavior of a bounded statistically homogeneous medium. The standard deviation in hydraulic head increases with an increase in either the standard deviation in hydraulic conductivity or the strength of the correlation between neighboring conductivity values. The standard deviation in head does not significantly depend upon the block size or the total number of blocks included along the flow line, provided a sufficiently accurate representation of the autocorrelation function is made. (Visocky-ISWS)
W80-00070

A DIRECT SOLUTION TO THE INVERSE PROBLEM IN GROUNDWATER FLOW,
Princeton Univ., NJ. Dept. of Civil Engineering.
D. H. Tang, and G. F. Pinder.
Advances in Water Resources, Vol. 2, No. 2, p 97-99, June 1979. 5 fig, 3 ref. NSF ENG76-18957.

Descriptors: *Transmissivity, *Groundwater movement, *Analytical techniques, *Model studies, Mathematical models, Groundwater, Aquifers, Pumping, Recharge, Natural recharge, Hydrologic properties, Aquifer characteristics, Finite difference analysis.

The inverse problem for transmissivity was solved deterministically using a finite difference approach. Steady state hydraulic heads calculated from a preliminary experiment were used as input data. It was shown that if the data on the hydraulic head are known at a sufficiently large number of points, there is no difficulty in setting up a finite difference grid and solving for transmissivity with an acceptable error. (Sims-ISWS)
W80-00081

BOUNDARY ELEMENT METHOD FOR FLUID FLOW,
Southampton Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W80-00083

SYSTEMATIC SAMPLING OF GAUSSIAN RANDOM PROCESSES AND FIELDS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
D. Veneziano, and C. S. Queiroz.
Water Resources Research, Vol. 15, No. 3, p 703-713, June 1979. 9 fig, 1 tab, 12 ref. NSF ENG75-19400.

Descriptors: *Sampling, *Network design, *Theoretical analysis, Probability, Stochastic processes, Groundwater, Water levels, Rainfall, Rain gages, Networks, Analytical techniques, Random processes, Bayesian analysis, Kolmogorov-Wiener's filter.

Linear observation of Gaussian random functions always results in reduction of uncertainty, and since the posterior central moments are precomputable, optimal linear sampling schemes for variance reduction are nonsequential. In particular, systematic sampling of homogeneous Gaussian processes and fields, the latter on rectangular grids, leads to simple variance-updating equations. Cases when measurements are noisy, when linear transformations of the uncertain function are observed or estimated, and when nonparametric uncertainty is superposed to a random parametric trend lead to simple variants of the direct observation/estimation model. The basic analytical tool is the Kolmogorov-Wiener filter, either in the frequency or in the space domain. Application areas include the design of rainfall collection networks, inference of soil properties for geotechnical use, mineral exploration, biological and environmental sampling, materials testing, and quality control. (Sims-ISWS)
W80-00089

SOLUTION OF LINEARIZED BOUSSINESQ EQUATION WITH STOCHASTIC BOUNDARIES AND RECHARGE,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering.
B. Sagar.
Water Resources Research, Vol. 15, No. 3, p 618-624, June 1979. 3 fig, 25 ref.

Descriptors: *Groundwater, *Groundwater movement, Recharge, *Model studies, Mathematical models, Natural recharge, Flow, Rivers, Statistics, Equations, Mathematics, Stochastic processes, Analytical techniques, Boussinesq equation.

By using the method of eigenfunction expansion, a solution to the linearized Boussinesq equation with stochastic initial conditions, boundaries, and recharge was obtained. The solution was obtained explicitly in the form of two expressions, one for the expected value of the dependent variable and the other for its covariance. The inclusion of both the Neumann and the Dirichlet boundary conditions was considered. It was found that the expected value of the dependent variable is the same as the solution of the deterministic problem with expected values of the input stochastic quantities. An example of the use of the solution was presented. From the result of the example it was seen that the initial condition contributes a major portion to the standard deviation of the dependent variable. (Sims-ISWS)
W80-00093

THE SIGNIFICANCE OF THE STORAGE PARAMETER IN SATURATED-UNSATURATED GROUNDWATER FLOW,
California Univ., Berkeley. Lawrence Berkeley Lab.
T. N. Narasimhan.
Water Resources Research, Vol. 15, No. 3, p 569-576, June 1979. 14 fig, 1 tab, 18 ref. Dep. Energy W-7405-ENG-48.

Descriptors: *Storage coefficient, *Aquifers, *Unsaturated flow, *Saturated flow, Groundwater movement, Consolidation, Effective stress, Porosity, Deformation, Porous media, Aquifer charac-

teristics, Theoretical analysis, Saturation, Void volume.

An essential feature of transient groundwater movement is the phenomenon of change in groundwater storage. Storage change is governed by three fundamental processes, change in void volume of the skeleton, change in fluid saturation, and change in fluid density. Since the expansivity of water is very small, the phenomenon of change in storage in fully saturated media is dominated by matrix deformation. When the soil is partially saturated, it is customarily assumed that the matrix is essentially rigid and that desaturation is the only process governing change in storage. While these assumptions may be reasonable at relatively low saturations, they may not be valid at high saturations or in the transition zone between the saturated and unsaturated regimes. The key to understanding of this lies in a proper appreciation of the constitutive relationships that exist between mechanical stresses on the one hand and moisture suction on the other. This paper examined the theoretical as well as the practical consequences of the role of soil deformation in saturated-unsaturated groundwater flow. (Visocky-ISWS)
W80-00094

DIFFUSION OF DISSOLVED GAS IN CONSOLIDATING POROUS MEDIA,
Middle East Technical Univ., Ankara (Turkey). Dept. of Geological Engineering.
M. Y. Corapcioglu.
Water Resources Research, Vol. 15, No. 3, p 563-568, June 1979. 7 fig, 21 ref.

Descriptors: *Diffusion, *Soil gases, *Porous media, *Soil compaction, Mathematical models, Permeability, Equations, Air entrainment, Groundwater movement, Consolidation, Pore pressure, Gases, Groundwater, Velocity, Seepage, Hydraulic properties, Model studies.

The diffusion of dissolved gas in liquid resulting from soil consolidation was analyzed as a function of time and space. The medium was assumed to be isotropic, finite, and filled with a homogeneous and incompressible fluid. Two cases of consolidation were considered to determine the fluid velocity expression. The model is useful to predict the concentration of dissolved gas in liquid for laboratory problems. (Visocky-ISWS)
W80-00095

TRICHLOROFLUOROMETHANE IN GROUNDWATER--A POSSIBLE TRACER AND INDICATOR OF GROUNDWATER AGE,
Indiana Univ. at Bloomington. Dept. of Geology.
G. M. Thompson, and J. M. Hayes.
Water Resources Research, Vol. 15, No. 3, p 546-554, June 1979. 5 fig, 3 tab, 33 ref.

Descriptors: *New Jersey, *Arkansas, *Texas, *Groundwater, *Tracers, *Dating, Age, Atmospheric fallout, Aerosols, Tritium, Gas chromatography, Analytical techniques, Groundwater recharge, Springs, Wells, Samples, *Trichlorofluoromethane, *Freon-11, Concentration.

Trichlorofluoromethane, an entirely man-made material, has become a detectable component of the atmosphere. Because of its unique atmospheric history, the presence of CC13F in groundwater is potentially significant in terms of groundwater age. The age relationship stems from the fact that precipitation, exposed to CC13F in the atmosphere, will pick up an amount that is proportional to the atmospheric CC13F concentration. If a portion of this water infiltrates into the subsurface to become groundwater, it can be differentiated from older groundwater (that infiltrated prior to the buildup of CC13F in the atmosphere) on the basis of its CC13F content. In order to evaluate the temporal significance of CC13F in groundwater, preliminary investigations were conducted in 3 areas where the hydrology was well understood and where tritium measurements had been made in the past. They were: the Wharton tract of southern New Jersey; Hot Springs National Park in Hot Springs, Arkansas; and the Edwards aquifer of south central Texas. Good agreement was observed between the CC13F data and the hydrologic controls. The Texas study also revealed a series of anomalous CC13F concentrations (up to 35 X 10 to the -9th power g CC13F/l H2O) that were too high to be of atmospheric origin. The anomalous points occurred in a line extending from the northwest corner of San Antonio for a distance of 74 km northeast along the Balcones fault zone and were interpreted as representing the migration of CC13F from a point source, thus indicating the potential of this and similar compounds as hydrologic tracers. (Visocky-ISWS)
W80-00096

A COMPARISON OF FLUORESCEIN DYE AND ANTIBIOTIC-RESISTANT ESCHERICHIA COLI AS INDICATORS OF POLLUTION IN GROUNDWATER,
Oregon State Univ., Corvallis. Dept. of Microbiology.
For primary bibliographic entry see Field 2G.
W80-00145

GROUND-WATER DATA IN THE BAKER COUNTY-NORTHERN MALHEUR COUNTY AREA, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
C. A. Collins.
Geological Survey open-file report 79-695, 1979. 28 p, 3 fig, 1 plate, 4 tab, 19 ref.

Descriptors: *Groundwater resources, *Water wells, *Springs, *Water yield, *Water quality, Well data, Drillers logs, Water level fluctuations, Water analysis, Chemical analysis, Aquifers, Oregon, *Baker County.

Ground-water data for the Baker County-northern Malheur area, Oregon, are tabulated for the Bureau of Land Management. The data include well and spring records, a well-location map, drillers' logs of wells, observation-well hydrographs, and chemical analyses of ground-water samples. The reported yields of wells and springs in the area ranged from less than 1 to 2,500 gallons per minute. Dissolved solids in ground-water samples ranged from 50 to 1,587 milligrams per liter, and arsenic ranged from 0.001 to 0.317 milligrams per liter. (Woodard-USGS)
W80-00226

GROUND-WATER RESOURCES OF WASHINGTON PARISH, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
H. L. Case, III.
Louisiana Department of Public Works Water Resources Technical Report No. 18, 1979. 33 p, 7 fig, 7 plates, 3 tab, 18 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water quality, *Water wells, *Water utilization, Water levels, Hydrographs, Hydrogeology, Groundwater availability, Water yield, *Washington Parish(La).

More than 31 million gallons per day of water is pumped from freshwater aquifers in Washington Parish, La. The aggregate thickness of freshwater sands ranges from 850 to 1,910 feet, and altitude of the base of freshwater ranges from 1,870 to 3,320 feet below National Geodetic Vertical Datum of 1929 (NGVD). The shallow aquifer in Washington Parish ranges in thickness from less than 50 feet to more than 400 feet. In local areas, wells completed in the shallow aquifer are capable of yielding as much as 2,900 gallons per minute. Water levels in wells in the shallow aquifer range from more than 10 feet above to more than 130 feet below land surface. Water from the shallow aquifer is generally low in dissolved solids, iron, and manganese concentrations; pH is generally less than 6.0 units. Eight major freshwater aquifers ranging in thickness from 50 to more than 360 feet and well depths ranging from less than 50 to more than 2,200 feet below land surface are available in the Bogalusa area. Four major aquifers have been identified in the Franklinton area. Thicknesses range from 100 feet in the Kentwood aquifer to 250 feet in the Franklinton aquifer. Well depths range from 585 feet (Kentwood aquifer) to 2,746 feet (Franklinton aquifer) below land surface. Water from the Kentwood and Franklinton aquifers contains low concentrations of dissolved iron and manganese. (Woodard-USGS)
W80-00227

DEVELOPING A STATE WATER PLAN, GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1979,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. Price.
Utah Division of Water Resources Cooperative Investigations Report No. 18, 1979. 68 p, 37 fig, 3 tab, 3 ref.

Descriptors: *Groundwater resources, *Utah, *Aquifers, *Withdrawal, *Water level fluctuations, Water quality, Water wells, Water utilization, Water supply, Irrigations, Hydrogeology, Aquifers, Water table, Potentiometric level, Groundwater recharge, Hydrologic data, Precipitation(Atmospheric), Surface-groundwater relationships, Hydrographs, Mapping.

The estimated total withdrawal of water from wells in Utah in 1978 was about 829,000 acre-feet, which was about 118,000 acre-feet less than in 1977 and 62,000 acre-feet greater than the average annual withdrawal for the period 1968-77. The decrease from 1977 was due primarily to decreases in withdrawals for irrigation. Precipitation in 1978 was above average in most of Utah. This made more surface water available, reducing dependence on ground water for irrigation. Relatively small ground-water declines were recorded in some of the more heavily developed areas. The above-average precipitation combined with increased runoff and reduced ground-water withdrawals, however, resulted in significant rises of ground-water levels in many parts of the State. (Woodard-USGS)
W80-00230

APPLICATION OF GEOCHEMICAL KINETIC DATA TO GROUND-WATER SYSTEMS: A TUFFACEOUS-ROCK SYSTEM IN SOUTHERN NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2K.
W80-00232

TWO-DIMENSIONAL AND THREE-DIMENSIONAL DIGITAL FLOW MODELS FOR THE SALINAS VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2A.
W80-00238

MAPS SHOWING GROUND-WATER CONDITIONS IN THE LOWER SANTA CRUZ AREA, PINAL, PIMA, AND MARICOPA COUNTIES, ARIZONA--1977,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-00239

USE OF DIGITAL MODELS TO MANAGE GROUND WATER,
Fox (F.M.) and Associates, Inc., Spokane, WA.
G. E. Maddox.
In: Watershed Management. Proceedings of a Symposium conducted by the Irrigation and Drainage Division of the American Society of Civil Engineers, Logan, Utah, August 1975. p 568-579, 1975. 6 fig, 2 ref. ASCE, New York, N.Y.

Descriptors: *Groundwater, *Management, *Model studies, *Water policy, *River basins, Projects, Hydrology, Water storage, Water level, Irrigation water, Columbia River(WA), *Quincy

basin(WA), Reservoirs, Systems analysis, Recharge, Percolation.

Reported is an investigation made of the Quincy basin, the northernmost of three groundwater basins within the Columbia Basin Project. The study determined, in quantitative terms, the amount of natural recharge in the basin and how much groundwater was stored there as a result of deep percolation of irrigation water imported by the Project. Discussed are two digital models used in the analysis of hydrologic data and the water management policy stemming from the first model. (Bell-Graf--Cornell)
W80-00252

BIOGEOCHEMISTRY OF A FORESTED ECOSYSTEM,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
For primary bibliographic entry see Field 4C.
W80-00328

EXACT AQUITARD RESPONSE FUNCTIONS FOR MULTIPLE AQUIFER MECHANICS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
E. O. Frind.
Advances in Water Resources, Vol. 2, No. 2, p 77-82, June 1979. 6 fig, 1 tab, 16 ref.

Descriptors: *Aquitards, *Aquifers, *Pumping, Water levels, Hydraulic conductivity, Groundwater, Theoretical analysis, Mathematical models, Equations, Analytical techniques, Aquitard response.

The aquitard response functions in multiple aquifer mechanics were examined in some detail, and a general family of response functions was derived. Taking advantage of the known fact that the nature of the aquitard response passes through different stages in time, three distinct response periods were identified, and time limits for each period were precisely defined. It was found that the response functions that are presently known as approximations are, for all practical purposes, exact if stated with the appropriate time constraints. (Sims-ISWS)
W80-00356

FRESHWATER AND THE FLORIDA COAST: SOUTHWEST FLORIDA.
For primary bibliographic entry see Field 6E.
W80-00367

IDENTIFICATION OF AQUIFER DISPERSIVITIES IN TWO-DIMENSIONAL TRANSIENT GROUNDWATER CONTAMINANT TRANSPORT: AN OPTIMIZATION APPROACH,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
A. Umari, R. Willis, and P. L-F. Liu.
Water Resources Research, Vol. 15, No. 4, p 815-831, August 1979. 2 fig, 10 tab, 26 ref, 1 append.

Descriptors: *Aquifers, *Dispersion, *Groundwater, *Optimization, *Methodology, *Contaminant transport, Nonlinear programming, Minimization, Quasilinearization, Inverse algorithm, Linear programs, Finite differencing, Discretize, Iterative procedure, Sensitivity, Finite element analysis, Constraints, Effects, Equations, Mathematical models, Systems analysis.

The problem of identifying unknown aquifer dispersivities in two-dimensional transient groundwater contaminant transport from given observations on the concentration field is addressed. This inverse problem is formulated as a general nonlinear programming problem, the purpose of which is to minimize the discrepancy between calculated and observed values of the concentration field. The method of quasilinearization is used to linearize the above problem, and the inverse algorithm becomes the solution of a sequence of linear programs that converge to the solution of the original nonlinear problem. The finite elements method in conjunction with finite differencing is used to discretize the governing differential equations which are then used as constraints for the optimization (mathematical programming) problem stated above. The effect on the inverse problem of the choice of observation points, objective function, number of finite elements, size of time step, and observation errors is studied. The proposed identification algorithm is shown to be fast, stable, and accurate. (Bell-Graf--Cornell)
W80-00393

2G. Water In Soils

THE COMPRESSIBILITY AND HYDRAULIC DIFFUSIVITY OF A WATER-STEAM FLOW,
Department of Scientific and Industrial Research, Wellington (New Zealand).
M. A. Grant, and M. L. Sorey.
Water Resources Research, Vol. 15, No. 3, p 684-686, June 1979. 5 ref, 1 append.

Descriptors: *Compressibility, *Diffusivity, *Porous media, *Flow, Theoretical analysis, Model studies, Mathematical models, Pressure, Temperature, Heat flow, Soil water, Soil water movement, Permeability, Soil science, Agriculture, Hydraulic diffusivity.

Physical parameters were defined for a flow of water and steam in a porous medium: dynamic and kinematic viscosity, density, and compressibility. These parameters permitted single-phase pressure transient theory to be applied to two-phase flow provided that the pressure changes are not too large. (Sims-ISWS)
W80-00090

FIELD TEST OF SOLUTION FLOW MODELS IN A HETEROGENEOUS IRRIGATED CROPPED SOIL,
Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soils and Water.
E. Bresler, H. Bielorai, and A. Laufer.
Water Resources Research, Vol. 15, No. 3, p 645-652, June 1979. 8 fig, 1 tab, 19 ref.

Descriptors: *Irrigation, *Model studies, *On-site investigations, Mathematical models, Soils, Soil water, Soil water movement, Moisture content, Hydraulic conductivity, Salts, Solutes, Salinity, Sprinkler irrigation, Crops, Agriculture, *Israel.

Data obtained from a controlled irrigation experiment in a citrus grove were compared with results obtained from simultaneous water and salt flow models considering water uptake by the trees. In the models, spatial variability in soil hydraulic properties was taken into account by using a single dimensionless scaling parameter which allowed the range of the soil water retentivity h(theta) and hydraulic conductivity K(theta) functions to be approximated with a probability of about 0.95. Measured data of water content profiles were obtained with the aid of the neutron probe method. Saturated paste extracts of disturbed soil samples were used for the measured salt profile data. Variability in the water and salt content observations was expressed in terms of the 95% confidence limits (CL) of the measurements made in 6 replications at each of the 3 experimental treatments. An irrigation period of 7 months was simulated and compared each year. The comparisons between models and experiments were based on average values, on ranges of CL of field data, and on simulated results computed with highly probable ranges of soil hydraulic properties. The results suggested that for estimating field values of water content (theta) and salt distribution profiles with approximate ranges of K(theta) and h(theta) at a given probability, the models have been sufficiently developed. (Sims-ISWS)
W80-00091

THE SIGNIFICANCE OF THE STORAGE PARAMETER IN SATURATED-UNSATURATED GROUNDWATER FLOW,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 2F.
W80-00094

DIFFUSION OF DISSOLVED GAS IN CONSOLIDATING POROUS MEDIA,
Middle East Technical Univ., Ankara (Turkey). Dept. of Geological Engineering.
For primary bibliographic entry see Field 2F.
W80-00095

METHOD AND DEVICE FOR DETERMINING THE PORE WATER PRESSURE IN A SOIL,
B-A. Torstensson.
U.S. Patent No. 4,148,212, 5 p, 3 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 2, p 436, April 10, 1979.

Descriptors: *Patents, *Measurement, *Pore water, *Pore pressure, Soil pressure, Soil physical properties, Equipment.

A method for determining the pore water pressure in a soil is described. A water-filled tube bearing a pore pressure sound at its lower end is installed at the required level. The pore pressure sound bears a filter through which the pore pressure in the soil is conveyed. A measuring device is lowered down the tube and fitted on to the pore pressure sound. The pore pressure is then allowed to stabilize after which a reading is taken which represents the pore pressure in the soil. The measuring device is disconnected from the pore pressure sound and a reading is taken which represents the water pressure in the tube. The pore pressure is calculated by comparison of the reading for pore water pressure and the water pressure in the tube, using a calibration factor for the measuring device. (Sinha-OEIS)
W80-00110

A COMPARISON OF FLUORESCEIN DYE AND ANTIBIOTIC-RESISTANT ESCHERICHIA COLI AS INDICATORS OF POLLUTION IN GROUNDWATER,
Oregon State Univ., Corvallis. Dept. of Microbiology.
T. M. Rahe, C. Hagedorn, and E. L. McCoy.
Water, Air, and Soil Pollution, Vol. 11, No. 1, p 93-103, January 1979. 1 fig, 2 tab, 12 ref. OWRT A-039-ORE(1).

Descriptors: *Soil water movement, *Tracers, *Oregon, On-site tests, Groundwater, Groundwater movement, Measurement, Testing procedures, Methodology, Tracking techniques, Subsurface waters, Fluorescent dye, E coli, Flow, Water pollution, Pollutants.

Field experiments were conducted to evaluate the performance of antibiotic-resistance Escherichia coli and yellow fluorescein dye as tracers of subsurface water flow. These materials were released into three horizontal lines installed in the A, B, and C horizons of a western Oregon hillslope soil. Movement was evaluated by collecting groundwater samples from rows of modified piezometers (6 piezometers/row) placed at various depths and distances downslope from the injection lines. The E. coli cells were transported rapidly through the experimental site and were recovered from piezometers 15 m downslope only 1 h after inoculation, while the rate by which the bacteria were moved was at least 1500 cm/h in the B-horizon. The strains of E. coli survived in large numbers for the duration of the 12 h sampling periods and appeared to be satisfactory as tracers of subsurface water flow. In contrast, the fluorescein dye was never visually detectable in any of the piezometers during any of the sampling periods, although very small, residual amounts could be fluorometrically measured. These results indicated that consideration should be given to more frequent use of marked strains of bacteria as tracers since these organisms may represent, in the final analysis, a very suitable option for closely monitoring subsurface movement and the spread of pollutants in soil and groundwater. (Humphreys-ISWS)
W80-00145

THERMAL CONDUCTIVITY OF SOILS AS A FUNCTION OF TEMPERATURE AND WATER CONTENT,
Oregon State Univ., Corvallis. Agricultural Experiment Station.

A. R. Sepaskhah, and L. Boersma.
Soil Science Society of America Journal, Vol. 43, No. 3, p 439-444, May-June 1979. 5 fig, 2 tab, 22 ref. OWRT B-028-ORE(7).

Descriptors: *Thermal conductivity, *Soil moisture, *Moisture content, *Temperature, Soils, Heat flow, Model studies, Measurement, Porosity, Diffusion, Air entrainment, Water vapor, Surface tension, Thermal properties, Mass enhancement factor, Pore size distribution.

Apparent thermal conductivities of loamy sand, loam, and silty clay loam soils were measured with a cylindrical heat probe at several water contents and temperatures. Values of lambda were also calculated with the de Vries model. Results showed that the model may be used satisfactorily to calculate lambda. The contribution of vapor distillation to thermal conductivity was analyzed by comparing lambda at 25 and 45 C. The ratios lambda sub 45/lambda sub 25 were nearly equal to unity when less than 5% of total pore space was filled with water. The ratios increased, due to vapor distillation, as water filled the pores and reached maximum values of 2.17, 2.71, and 2.96 when 22, 27, and 35% of total pore space was filled with water corresponding to soil water potentials of -0.8, -9.0, and -8.0 bars for loamy sand, loam, and silty clay loam, respectively. As the water content increased further, the ratios decreased and approached unity when more than 50% of total space was filled with water. The apparent thermal conductivity was independent of water content at very low water contents. The water molecules are in layers only a few molecules thick. The water content below which the apparent thermal conductivity is not affected by water content is a function of the soil temperature and the clay content. In the reported experiments, these water contents were 0.03 and 0.05 cu cm/cu at 45 C and 0.13 and 0.18 cu cm/cu cm at 25 C for the loam and silty clay loam, respectively. (Visocky-ISWS)
W80-00146

SIMPLE TIME-POWER FUNCTIONS FOR RAINWATER INFILTRATION AND RUNOFF,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
R. M. Dixon, J. R. Simanton, and L. J. Lane.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Az., p 79-89, 7 tab, 5 fig, 19 ref.

Descriptors: *Infiltration, *Rainfall-runoff relationships, *Runoff, *Runoff forecasting, *Soil water movement, Infiltrometers, Irrigation practices, Rain water, Rainfall disposition, Air-earth interfaces, Equations, Forecasting, Regression analysis, Erosion.

The main purpose of the study was to evaluate several simple infiltration equations for use in quantifying the air-earth interface (AEI) descriptive concept developed by Dixon (1977) for controlling rainwater infiltration. Eight equations, Darcy's Kostiakov's, Ostashev's and four modified Philip equations were least square fitted to data from ring, border-irrigation, closed-top; and sprinkling infiltrometers and evaluated for use in predicting and controlling rainwater infiltration and rainwater excess in crop and rangelands. The 16 evaluation criteria elucidated here were developed to facilitate the initial screening of the many infiltration equations to select several for subsequent fitting accuracy tests and to guide final selection of the best equation for modeling the AEI concept. The 8 equations which were also fitted to rainfall data to permit the calculation of runoff from a small surface area, were compared by resultant regression curves to indicate that land management practices that suitably alter the soil surface will permit the control of infiltration runoff and erosion. Kostiakov's equation was selected for modeling the AEI concept of infiltration because of its ability to accurately and consistently fit data from diverse sources and its meaningful parameters which provide a convenient method for summarizing infiltration data and predicting and controlling infiltration and runoff. (Tickes-Arizona)
W80-00279

A MICROROUGHNESS METER FOR EVALUATING RAINWATER INFILTRATION,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
J. R. Simanton, R. M. Dixon, and I. McGowan.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Falgstaff, Arizona, p 171-174, 2 fig, 8 ref.

Descriptors: *Measurement, *Soil surfaces, *Soil water movement, *Infiltration, *Instrumentation, Earth-water interfaces, Ranges, Infiltrometers, Moisture meters, Microenvironments, Arizona.

Described is a microroughness meter developed to obtain numerous and accurate measurements of rangeland surface microroughness and characteristics. The meter, which consists of four basic parts: (1) meter base and pin guide, (2) pin lifting support bar and lifting mechanism, (3) 100 vertically moving pins, and (4) stripchart support guide and winding mechanism, was designed to measure soil surface evaluations and characteristics of a 1m2 plot. Performance tests on multi-plot sprinkler infiltrometer studies conducted on the Santa Rita Experimental Range in southeastern Arizona indicated that the meter was accurate and relatively precise in repeating soil surface roughness measurements but was not precise in defining the theoretical characteristics of constructed surfaces. It was concluded, however, that these errors in precision were insignificant and due partly to surface geometry construction errors and that the meter is a convenient, quick, simple and accurate means of measuring surface roughness in studies requiring many plots and data points. (Tickes-Arizona)
W80-00291

SUBSTRATE CONDITIONS, COMMUNITY STRUCTURE AND SUCCESSION IN A PORTION OF THE FLOODPLAIN OF WISSAHICKON CREEK,
For primary bibliographic entry see Field 2B.
W80-00310

PYRITE: ITS RAPID FORMATION IN A SALT MARSH AND ITS IMPORTANCE TO ECOSYSTEM METABOLISM,
Woods Hole Oceanographic Institution, MA. Joint Program in Biological Oceanography.
For primary bibliographic entry see Field 2K.
W80-00311

MARSH SOILS OF THE ATLANTIC COAST,
Delaware Univ., Newark. Dept. of Plant Science.
L. J. Cotnoir.
In: Ecology of Halophytes, Reimold, R. J., and Queen W. H. (eds.). Academic Press, Inc., New York, p 441-447, 1974. 21 ref.

Descriptors: *Marshes, *Soil classifications, Wetlands, Salt marshes, Peat, Soil tests, Remote sensing, Atlantic coastal plain.

Recent attempts to classify marsh soils are reviewed and the difficulties involved in studying and mapping marsh soils are discussed. (Steiner-Mass)
W80-00320

PRIMARY PRODUCTIVITY OF ALPINE MEADOW COMMUNITIES,
F. E. Wielgolaski.
In: Fennoscandian Tundra Ecosystems: Plants and Microorganisms, edited by F. E. Wielgolski, Springer-Verlag, N.Y., Heidelberg, Berling, p 121-128, 1975. 1 fig, 4 tab, 25 ref.

Descriptors: *Primary productivity, *Alpine, *Grasslands, *Biomass, *Standing crop, Willow trees, Shrubs, Grasses, Roots, Ferns, Mosses, Algae, Fungi.

Comparing plant production in a dry and wet alpine meadow indicated wet meadows had greater plant production than dry, with a large part of that production occurring in roots. Fertilizer studies indicated a weak tendency to increase yield with the largest amount of mixed fertilizer. The living root biomass is higher than aboveground live biomass. The shoot-root ratio is lowest for Carex species. Most roots were in the upper 10 cm soil layer; in the wet meadow, more than 60%--in the dry, somewhat less. Only 15-20% of the roots are living below a 10 cm depth in the wet meadow. There are more live roots compared to dead in the dry meadow than in the wet. About 4-5% of the total material of bryophytes is dead in the upper 5-6 cm in the wet meadow. Green vascular plant material in the dry meadow may increase by 85 gm to the minus 2nd power, and in the wet by 80 gm to the minus 2nd power. The primary production of roots is higher in the wet than in the dry meadow. The production of cryptogams is 3 to 4 times higher in the wet than dry meadow. (Otello-Mass)
W80-00324

2H. Lakes

USE OF COMPLEX PALEOGEOGRAPHIC METHOD TO RECOGNIZE THE HISTORY OF DISTROPHIC LAKES AND HIGH BOGS AS EXEMPLIFIED BY AN INTERGLACIAL LAKE AT GOLKOW NEAR WARSZAWA,
S. Z. Rozycki.
Polskie Archiwum Hydrobiologii, Vol. 25, No. 1/2, p 361-367, 1978. 5 fig, 7 ref.

Descriptors: *Lakes, *Paleoclimnology, *History, Bogs, Palynology, Geomorphology, Glaciation, Stratigraphy, Hydrogeology, Geologic mapping.

A complex paleogeographic and stratigraphic analysis has been done taking as an example a distrophic interglacial lake. It was based on various geomorphological hydrologic, sedimentological, and palynological data. The subsequent changes in the extents of the lake waters and changes of the landscape in the vicinity during the main climatic oscillations from the decline of the Middle-Polish glaciation till recent times are shown. It has been found that the lake basin was infilled with water during the three warmest phases of the Eemian interglacial. The lake has disappeared after the second interglacial optimum. The subsequent history of the lake basin embraces next phases of its erosional dissection and infilling with sediments during the last great cold phase of the Wurm. (Steiner-Mass)
W80-00007

SEASONAL CHANGES OF PHRAGMITES COMMUNIS TRIN. PART I. GROWTH, MORPHOMETRICS, DENSITY AND BIOMASS,
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
For primary bibliographic entry see Field 2I.
W80-00011

ROLE OF CARBOHYDRATE IN HALOPHYTES OF THE REGION OF NEUSIEDLER LAKE, AUSTRIA, (IN GERMAN),
Vienna Univ. (Austria). Pflanzenphysiologisches Inst.
For primary bibliographic entry see Field 2I.
W80-00021

PRIMARY PRODUCTIVITY OF EMERGENT MACROPHYTES IN A WISCONSIN MARSH ECOSYSTEM,
Wisconsin Univ.-Milwaukee. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-00026

DEPRESSION OF PH IN LAKES AND STREAMS IN CENTRAL ONTARIO DURING SNOWMELT,

Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
D. S. Jeffries, C. M. Cox and P. J. Dillon.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 6, p 640-646, June 1979. 1 fig, 4 tab, 28 ref.

Descriptors: *Snowmelt, *Water quality, *Canada, *Lakes, *Hydrogen ion concentration, Streams, Surveys, Surface runoff, Spring, On-site data collections, Watersheds(Basins), Sampling, Water pollution sources, Methodology, Acidity, Analysis, Snowpacks, Foreign research, On-site investigations, *Ontario(Canada).

The snowpack that accumulated in central Ontario in the winter of 1977-78 had a pH of 4.0-4.5. The resultant runoff in the following spring in three intensively studied watersheds was characterized by a 2-13-fold increase in H(+) content. Between 36 and 77% of the year's export of H(+) from the watersheds occurred in April. Similar pH depressions were observed in almost all of 17 other streams that were less frequently sampled and in the littoral zones, surface waters, and outflows of 5 lakes. (Humphreys-ISWS)
W80-00076

BOUNDARY ELEMENT METHOD FOR FLUID FLOW,
Southampton Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W80-00083

GREAT LAKES BEGINNING-OF-MONTH WATER LEVELS AND MONTHLY RATES OF CHANGE OF STORAGE,
National Oceanic and Atmospheric Administration, Ann Arbor. MI. Great Lakes Environmental Research Lab.
F. H. Quinn, J. A. Derecki, and R. N. Kelley.
Journal of Great Lakes Research, Vol. 5, No. 1, p 11-17, 1979. 2 fig, 9 tab, 11 ref.

Descriptors: *Great Lakes, *Water levels, *Storage, Data processing, Analytical techniques, Fluctuations, Water level fluctuations, Variability, Lakes, Water storage, Water resources, Water supply, Gages, Gaging stations, Limnology, *Lake St Clair.

Time series of beginning-of-month water levels and rates of change of lake storage were determined for each of the Great Lakes and Lake St. Clair for 1941-1975 period. The Thiessen polygon procedure was used to compute the beginning-of-month levels because it provides more representative overall lake levels than straight averaging and requires minimum subjectivity. The effect of crustal movement on the rate of change of lake storage was investigated and found to be negligible. A gage density analysis showed good agreement between various size gage networks with the maximum deviation between networks decreasing with increasing gage density. Thiessen polygon weighting factors were presented for the current gage networks to enable future extension of the time series. (Sims-ISWS)
W80-00087

DIAGENESIS OF ORGANIC MATTER IN THE SEDIMENTS OF LAKES ONTARIO, ERIE, AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2K.
W80-00088

HYPOLIMNETIC OXYGEN DEPLETION IN CENTRAL LAKE ERIE: HAS THERE BEEN ANY CHANGE,
Canada Centre for Inland Waters, Burlington (Ontario).
M. N. Charlton.
Scientific Series No. 110, 1979, 24 p, 11 fig, 3 tab, 3 ref, 2 append.

Descriptors: *Lake Erie, *Hypolimnion, *Oxygen, *Eutrophication, *Temperature, *Mesotrophy, Lake morphology.

A new analysis of hypolimnetic oxygen in central Lake Erie indicates that historic increases in the apparent depletion were not as great as formerly believed. The differences that did occur were mostly related to variations in hypolimnion thickness. Changes, if any, in the oxygen depletion rate due to eutrophication are as yet too small to be recognized. Present-day oxygen depletion rates, when corrected for the relatively high temperatures in Lake Erie, are within the range thought to be indicative of mesotrophy in small lakes. The general level of oxygen depletion observed in the Central Basin of Lake Erie is expected on the basis of morphology alone. (WATDOC)
W80-00197

PERSPECTIVES ON LAKE ECOSYSTEM MODELING.
Ann Arbor Science Publishers Inc., Michigan, 1979. 326 p, Scavia, D., and Robertson, A. (Eds.).

Descriptors: *Lakes, *Ecosystems, *Model studies, *Aquatic environment, *Great Lakes, *Simulation analysis, *Management, *Water quality, *Research needs, Phytoplankton, Zooplankton, Planning, Sampling, Hydrodynamics, Food chains, Equations, Systems analysis, Cost minimization, Hazardous substances, Resource management.

Modeling should be an integral part of both basic research and applied management programs for aquatic ecosystem study. This book consists of papers which consider lake ecological model usage, possible model improvements, and new directions for development. Most of the papers included have been taken from a special symposium on ecological modeling at the 20th Conference on Great Lakes Research at the University of Michigan in 1977. The book is divided into four sections, each dealing with an individual area of aquatic ecosystem research and the role of models in that area. Section One, Improved Model Components, considers: scale in modeling large aquatic ecosystems; an experimental and modeling review of water column death and decomposition of phytoplankton; zooplankton grazing in simulation models--the role of vertical migration; and mathematical modeling of phosphorus dynamics. Section Two, Identification of Research Needs Through Model Studies, considers: Modifications to the model Cleaner; and the use of ecological lake models in information synthesis. Section Three, Models in Management, contains: Predictive water quality models for the Great Lakes; empirical lake models for phosphorus; and a least-cost surveillance plan for water quality trend detection in Lake Michigan. Section Four, New Directions in Ecosystem Analysis, presents: preliminary insights into a three-dimensional ecological-hydrodynamic model; study of ecosystem properties of Lake Ontario using an ecological model; and an analysis of PCB in Lake Ontario using a size-dependent food chain model. (See W80-00204 thru W80-00216) (Bell-Graf--Cornell)
W80-00204

CONSIDERATIONS OF SCALE IN MODELING LARGE AQUATIC ECOSYSTEMS,
State Univ. of New York at Albany. Dept. of Biological Sciences.
D. C. McNaught.
In: Perspectives on Lake Ecosystem Modeling. p 3-24, 1979. 4 fig, 5 tab, 29 ref.

Descriptors: *Lakes, *Ecosystems, *Model studies, *Aquatic environment, *Plankton patchiness, *Data interpretation, *Spatial-temporal scales, Distribution, Standing crops, Nutrients, Great Lakes, Excretion, Grazing, Biomass, Fish, Zooplankton, Phytoplankton, Systems analysis.

Scales of phytoplankton and zooplankton distributions characteristic of large lakes have been described and the most common ones related to causal factors. Phytoplankton aggregations were characterized by scales of hundreds of meters and tens of kilometers. Examples from small lakes tentatively suggested the existence of smaller scales (meters and centimeters). Zooplankton distributions in the Laurentian Great Lakes were characterized by scales of meters, while longer scales have not been observed, probably because sampling programs that would detect them have not been carried out. Scales for fishes and zooplankton were similar, and thus at least the physical mechanisms controlling their distributions are likely the same. Spatial-temporal interactions may serve to magnify small-scale differences in plant or animal densities and associated fluxes. Coincidence in spatial-temporal scales is necessary for heterogeneity to lead to functional interrelationships between phytoplankton, zooplankton and planktonphagous fishes. Information on the scales of spatial-temporal heterogeneity for important trophic components is vital to model calibration. (See also W80-00204) (Bell-Graf--Cornell)
W80-00205

WATER COLUMN DEATH AND DECOMPOSITION OF PHYTOPLANKTON: AN EXPERIMENTAL AND MODELING REVIEW,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
J. V. DePinto.
In: Perspectives on Lake Ecosystem Modeling. p 25-52, 1979. 7 fig, 83 ref.

Descriptors: *Ecosystems, *Phytoplankton, *Biomass, *Lakes, *Simulation analysis, *Experiments, *Phytoplankton-decomposition interactions, Mathematical models, Systems analysis, Algae, Nutrients, Eutrophication, Decay, Respiration, Regeneration, Death, Water column, Chemical processes, Biological processes.

Discussed is the importance of a component of ecosystem models often neglected: Phytoplankton-decomposition interactions. Results from field and laboratory studied are used to illustrate the importance of decomposers in controlling phytoplankton biomass and dynamics and thus to highlight the danger in a superficial treatment of the decomposers. Deterministic phytoplankton models are basically an ordered framework of mechanistic or semiempirical submodels. The success of a given model depends on the inclusion of all important submodels and the means used to mathematically describe a given process. Discussed is the bacteria-mediated decomposition of phytoplankton and related organic matter and the subsequent remineralization of algal growth-regulating nutrients. Reviewed are the latest attempts by modelers to respond to the inadequate understanding of and attempts to describe these processes: The building of submodels for death and decomposition of algae in the water column. These processes appear to be more significant in highly productive eutrophic lakkes. Research suggests that estimates of biological losses from phytoplankton biomass in lakes must include algal respiration, natural algal mortality, microbial-induced algal mortality, and grazing by higher trophic organisms. The criterion for success or failure should depend on qualitative knowledge and direct measurement of the processes involved. (See also W80-00204) (Bell-Graf--Cornell)
W80-00206

ZOOPLANKTON GRAZING IN SIMULATION MODELS: THE ROLE OF VERTICAL MIGRATION,
Michigan Univ., Ann Arbor. Great Lakes and Marine Waters Center.
J. A. Bowers.
In: Perspectives on Lake Ecosystem Modeling. p 53-73, 1979. 3 fig, 3 tab, 3 equ, 72 ref.

Descriptors: *Zooplankton, *Model studies, *Simulation analysis, *Grazing, *Effects, *Vertical migration, *Ecology, *Lakes, Plankton, Temperature, Depth, Lake Michigan, Equations, Herbivores, Endogenous cycles, Ingestion rate, Chlorophyll concentration, Systems analysis.

Examined is the relationship between vertical migration and grazing in zooplankton. Laboratory and field data are used to illustrate and describe the influence of migration and several previously pub-

lished models of migration are described. Vertical migration complicates the simulation of grazing pressure in time and space; needed is a comprehensive theory explaining the evolution, controlling factors, and adaptive advantages of these migrations. Presented are the approaches taken by two often opposing groups--the modelers and the ecologists. Discussed are: (1) grazing equations in simulation models; (2) diel vertical migration; (3) models incorporating vertical migration; (4) vertical distribution of phytoplankton; and (5) the effects of depth position and endogenous cycles. It is concluded that modelers and zooplankton ecologists have much to offer each other when dealing with vertical migration. Modeling provides a reasonable approach to assess the implication of errors which result in hypotheses where generalizations and conclusions are intuitively difficult. Future hypotheses must include nitrogen and phosphorus excretion, size selective feeding and migration as an avoidance behavior from vertebrate and invertebrate predators; this will benefit most from the use of models as investigatory tools. (See also W80-00204) (Bell-Graf--Cornell)
W80-00207

MATHEMATICAL MODELING OF PHOSPHORUS DYNAMICS THROUGH INTEGRATION OF EXPERIMENTAL WORK AND SYSTEM THEORY,
Canada Centre for Inland Waters, Burlington (Ontario).
E. Halfon.
In: Perspectives on Lake Ecosystem Modeling. p 75-83, 1979. 4 fig, 2 tab, 13 ref.

Descriptors: *Phosphorus, *Model studies, *Freshwater, *Simulation analysis, Equations, Systems analysis, Ecosystems, Experiments, Model order estimation, Parameter estimation, Behavior, Model compartments, Transfer function, Weighting factor.

System theory provides the basis for modeling and simulation; experimental work provides the data necessary to validate the model. Model order estimation and parameter estimation techniques have been used to develop a theoretical model of phosphorus dynamics in freshwater, based on work by Lean (1973). Results indicate that a model less aggregated than that proposed by Lean is more adequate. Specifically, particulate phosphorus should be modeled with more than one compartment. (See also W80-00204) (Bell-Graf--Cornell)
W80-00208

MODIFICATIONS TO THE MODEL CLEANER REQUIRING FURTHER RESEARCH,
Rensselaer Polytechnic Inst., Troy, NY. Center for Ecological Modeling.
R. A. Park, T. W. Groden, and C. J. Desormeau.
In: Perspectives on Lake Ecosystem Modeling. p 87-108, 1979. 3 fig, 1 tab, 97 ref.

Descriptors: *Phosphorus, *Model studies, *Simulation analysis, *MS CLEANER, *Process-level research, *Aquatic environment, *Ecosystems, *Systems analysis, *Model structure, Research needs, Biological realism, Phytoplankton, Decomposers, Zooplankton, Fish, Sediments, Lakes.

Demonstrated is the application of systems theory techniques to identify the appropriate structure for a model, in this case a model simulating phosphorus cycling. The model structure herein indicates that in addition to those components usually deemed important, other phosphorus fractions are important in the dynamics of the phosphorus cycle. The recent trend in ecological modeling has been to include more biological realism. A result has been MS. CLEANER, one of the more complex and biologically realistic ecosystem models. Current research with this model has suggested that continued model development is limited by the state of knowledge in aquatic ecology. Three levels of research are needed: (1) process-level research (special experiments to aid in formulation of constructs representing environmental responses for specific processes); (2) detailed measurements to determine parameter values for old and new constructs; and (3) comprehensive studies at experimental sites. This chapter focuses on the first of these, felt to have the greatest impact on modeling. Emphasized are those research areas of particular concern in the current development of MS. CLEANER. Considered are: (1) phytoplankton (light and temperature limitation, nutrient limitation, mortality, and sinking); (2) decomposers (colonization, and uptake of organic and inorganic materials); (3) zooplankton (starving and resting states, and excretion); (4) fish (adaptive prey preference, and migration) and (5) sediments. (See also W80-00204) (Bell-Graf--Cornell)
W80-00209

THE USE OF ECOLOGICAL MODELS OF LAKES IN SYNTHESIZING AVAILABLE INFORMATION AND IDENTIFYING RESEARCH NEEDS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
D. Scavia.
In: Perspectives on Lake Ecosystem Modeling. p 109-168, 1979. 6 fig, 2 tab, 23 equ, 223 ref.

Descriptors: *Ecology, *Lakes, *Mathematical models, *Aquatic environment, *Research, Nutrients, Phytoplankton, Zooplankton, Bacteria, Fish, Sediments, Hydrodynamics, Systems analysis, Simulation analysis, Equations, Trophic, Process constructs.

Discussed are the major subdivisions of aquatic ecosystems, in terms of the constructs used to represent them in several ecological models and the experimental information used to support these constructs. Weaknesses in our understanding of these components, as identified by the state of present models, are considered, and research priorities to remove these weaknesses are recommended. The development of aquatic ecological modeling programs often minimizes the importance of identifying and setting research priorities; this chapter focuses specifically on research areas that presently represent blocks to further model development and suggests a hierarchical priority system. The models reviewed are restricted to those developed over the past decade that address the trophic ecology of the aquatic system (i.e., food chain simulation models). Discussed are: (1) nutrients (phosphorus, nitrogen, carbon, silicon, and nutrient recycling); (2) phytoplankton, including functional groups (physiology, size) and process constructs (uptake/growth, respiration, sinking, luxury consumption); (3) zooplankton, also including functional groups and process constructs (consumption, selective feeding, respiration); (4) bacteria; (5) fish; (6) sediment; and (7) hydrodynamics. The final section considers research needs, wherein information gaps lie within three categories: (1) component descriptions; (2) process constructs; and (3) coefficient values. Discussed are numerous components from category 1, including silicon cycling, multiple nutrient limitation, grazing, and field observations of process rates. These components have not yet been described quantitatively in terms of their interrelationships within the whole system. (See also W80-00204) (Bell-Graf--Cornell)
W80-00210

PREDICTIVE WATER QUALITY MODELS FOR THE GREAT LAKES: SOME CAPABILITIES AND LIMITS,
McMaster Univ., Hamilton (Ontario).
W. J. Snodgrass.
In: Perspectives on Lake Ecosystem Modeling. p 171-191, 1979. 3 fig, 19 ref.

Descriptors: *Water quality, *Model studies, *Great Lakes, *Management, Assessment, Nutrients, Simulation analysis, Eutrophication, Systems analysis, Decision making, Model adequacy, Model development, Modeling framework, *Prediction, Box approach.

A major concern of water quality managers is the eutrophication of the Great Lakes. Presented is a framework for assessing some capabilities and limitations of predictive water quality models. Using this framework, several such models are critiqued; these are fundamental quantitative models describing part or all of the St. Lawrence Great Lakes System. Their objectives are (1) to provide a useful predictive basis for making decisions concerning water quality management alternatives and/or (2) to describe mathematically the most important interactions between various nutrient cycles and biological species. The framework describes the modeling process as consisting of six steps: definition of model objectives, system discretization, model construction, model calibration, model verification and model prediction. It is concluded that the box approach for modeling lakes is a useful and verified approach for considering spatial scales of the whole lake and temporal scales on the order of a year. (See also W80-00204) (Bell-Graf--Cornell)
W80-00211

EMPIRICAL LAKE MODELS FOR PHOSPHORUS: DEVELOPMENT, APPLICATIONS, LIMITATIONS AND UNCERTAINTY,
Michigan State Univ., East Lansing. Dept. of Resource Development.
K. H. Reckhow.
In: Perspectives on Lake Ecosystem Modeling. p 193-221, 1979. 3 fig, 7 tab, 34 equ, 28 ref.

Descriptors: *Lakes, *Phosphorus, *Model studies, *Statistical methods, *Simulation analysis, *Error analysis, *Black box models, Probability, Systems analysis, Equations, Evaluation, Lake classification, Model comparison, Uncertainty, Empirical models, Management.

As opposed to ecosystem simulation models, which are complex and designed to describe the interactions among the components of the aquatic ecosystem, black box or empirical models are highly aggregated and are designed to examine the concentration (or its annual changes) of a single component, generally phosphorus or chlorophyll a. They are developed from multi-lake, cross-sectional analyses, yet are often applied for single-lake, longitudinal prediction (forecasting over time) purposes. Each of these two basic types of lake models is useful in the understanding and management of lake ecosystems; it is important to understand the uses and limitations of each model type. Traced herein is the development of simple black box or empirical phosphorus lake models. A number of approaches is examined, criteria are suggested for model evaluation and discrimination, and the limitations of each model are outlined. Described is the use of first-order uncertainty analysis for establishing bounds on predictions made by mathematical models. The error analysis is used to compare prediction confidence among the models of total phosphorus dynamics presented. These models may prove most useful in (1) suggesting general trends in lake quality, (2) providing a quick assessment of quality and a first cut at phosphorus 'carrying capacity' for a number of lakes, and (3) introducing useful quantitative techniques to planners and decision makers in lake management who have not previously applied mathematical models. (See also W80-00204) (Bell-Graf--Cornell)
W80-00212

PRELIMINARY INSIGHTS INTO A THREE-DIMENSIONAL ECOLOGICAL-HYDRODYNAMIC MODEL,
Tetra Tech., Inc., Lafayette, CA.
C. W. Chen, and D. J. Smith.
In: Perspectives in Lake Ecosystem Modeling. p 249-279, 1979. 23 fig, 2 tab, 23 ref.

Descriptors: *Hydrodynamics, *Ecology, *Model studies, *Lake Ontario, *Aquatic environment, *Water quality, *Simulation analysis, Feasibility, Great Lakes, Currents(Water), Velocity, Annual, Daily, Temperature, Dissolved oxygen, Algae, Mass transport, Heat transfer, Biological changes, Chemical reactions, Systems analysis.

As part of the data analysis program for the International Field Year for the Great Lakes, a comprehensive water quality-ecological model for Lake Ontario has been developed. The model simulates mass transport, heat transfer, biological transformations and chemical reactions and provides an integrated interpretation of physical, chemical and biological data observed in the field. This paper

presents the model, the preliminary simulation results and information gained from the modeling effort. The authors explore the feasibility of coupling a relatively sophisticated ecosystem model with a complex hydrodynamic model in order to simulate the above properties of a lake in three dimensions of space as well as the fourth of time. The Lake Ontario model is comprised of three basic modules: hydrodynamic, interface, and water quality. (See also W80-00204) (Bell-Graf--Cornell)
W80-00214

THE EXAMINATION OF ECOSYSTEM PROPERTIES OF LAKE ONTARIO THROUGH THE USE OF AN ECOLOGICAL MODEL,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
A. Robertson, and D. Scavia.
In: Perspectives in Lake Ecosystem Modeling. p 281-292, 1979. 4 fig, 5 tab, 8 ref.

Descriptors: *Lake Ontario, *Ecosystems, *Mathematical models, *Great Lakes, *Simulation analysis, *Value, Atmosphere, Hypolimnion, Epilimnion, Sediments, Concentrations, Seasonal, Trophic level, Efficiencies, Carbon budgets, Herbivores, Carbon cycling diagrams, Turnover times, Systems analysis.

There has been little study of the usefulness of models for understanding the basic ecological processes in the Great Lakes. The authors developed an ecosystem model for Lake Ontario which simulates the general features of the Ontario ecosystem quite well. Using an updated version of this model, an investigation is made herein of the utility of employing the modeling approach to study certain basic ecological properties of the system, properties which in many cases are almost impossible to examine in an ecosystem as large as Ontario with direct field measurements. Presented are examples of properties which can be investigated and attempts to evaluate the validity and usefulness of this approach for gaining insights into large ecosystems. Discussed are: carbon cycling diagrams, relative concentrations, hypolimnion/epilimnion concentration ratios, carbon budgets for separate categories, turnover times, and trophic level efficiencies of carbon intake. In conclusion, ecosystem models have substantial potential as tools for basic ecology and their use for such a purpose well deserves further investigation. (See also W80-00204) (Bell-Graf--Cornell)
W80-00215

FISHERY SURVEY OF CEDAR LAKES AND THE BRAZOS AND SAN BERNARD RIVER ESTUARIES,
Texas Parks and Wildlife Dept., Austin.
R. B. Johnson, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 744, Price codes: A04 in paper copy, A01 in microfiche. Technical Series No. 23, 1977. 65 p, 23 fig, 9 tab, 18 ref, 1 append.

Descriptors: *Fisheries, *Sampling, *Census, *Estuaries, *Freshwater, Invertebrates, Fish, Texas, Lakes, Rivers, Wetlands, Aquatic habitats, Estuarine fisheries, Marine fisheries, Freshwater fish, Commercial fishing, Sport fishing, Water properties, Salinity, Water temperature, Dissolved oxygen, Hydrogen ion concentration, Turbidity, Water pollution, Trawling, Dredging, Nets.

A fishery study of Cedar Lakes and the lower parts of the Brazos and San Bernard Rivers, Texas, was conducted from February 1973 to January 1975. Samples were collected at 17 stations each month to determine hydrological conditions and occurrence of estuarine organisms. Salinity, temperature, dissolved oxygen values, pH values, and turbidity were determined in surface and bottom water samples. Of 146 species of fish and invertebrates observed or caught in the study area, 35 were marine species which contribute to Texas' recreational and commercial fisheries. An annotated checklist is presented. Vital fisheries habitat is identified. Pollution in the lower Brazos River has eliminated 9.8 to 21.1 km (depending upon weather conditions) of stream bottom from substantial fisheries production. Information collected was also used to map 'nursery' habitat of 10 species of fish and crustaceans of economic value. (Bollinger-Mass)
W80-00305

VEGETATION CHANGES IN A SHALLOW AFRICAN LAKE: RESPONSE OF THE VEGETATION TO A RECENT DRY PERIOD,
Rhodes Univ., Grahamstown (South Africa). Inst. for Freshwater Studies.
C. Howard-Williams.
Hydrobiologia, Vol. 47, No. 3-4, p 381-397, December 1, 1975. 3 fig, 5 tab, 28 ref.

Descriptors: *Lakes, *Vegetation, *Droughts, *Stability, Mud flats, Lake beds, Lake basins, Salinity, Biota.

Changes in vegetation on the lake bed of a shallow African lake in response to a dry period consisted of a pre-drying, dry, refilling, and post-filling stage. During pre-drying, Typha domingensis predominated the lake margins. Diplachne fusca, Cyperus laevigatus, and Aeschynomene pfundii survived on the mud flats characterized by alkaline clays in the basin during the dry phase. Almost pure stands of Diplachne fusca and Aeschynomene pfundii occurred as new vegetation during the refilling phase. However, opposite river inflows and on sandy soils, a variety of species developed. During the post-filling stage Cyperus laevigatus, Diplachne fusca and Aeschynomene pfundii died as the waters rose. The lake margins once again reverted to the pre-drying phase vegetation of Typha. Due to the lake's rapid recovery (inside two years) of its biota after the dry period, it may have a high degree of biological stability. Aeschynomene pfundii thrived in deep water but was unable to regenerate since seed germination could not occur underwater. The salinity of the lake during low water and drying period prevented Typha domingensis from colonizing the lake bed extensively. (Otello-Mass)
W80-00313

EFFECTS OF A DRAWDOWN ON A WATERFOWL IMPOUNDMENT,
Michigan Dept. of Conservation, Lansing. Rose Lake Wildlife Experiment Station.
J. A. Kadlec.
Ecology, Vol. 43, No. 2, p 267-281, Spring, 1962. 8 fig, 5 tab, 46 ref.

Descriptors: *Drawdown, *Water levels, *Impoundments, *Waterfowl, Mallard ducks, Black ducks, Blue-winged teal, Soil analysis, Water analysis, Invertebrates, Vegetation.

A pilot drawdown on the Backus Lake flooding project in north-central lower Michigan was evaluated during the summer of 1958 along with its effect on vegetation, waterfowl, soil, water, and bottom fauna. Plant species composition was not notably affected. Common perennials were able to survive drainage for one growing season. Many submerged and floating-leaf species were reduced in abundance. Water lilies were little affected except in severely dried areas. Water smartweed and bushy pondweed grew luxuriantly after the drawdown. Most emergents spread and increased in abundance. Sedges and woolgrass were most abundant on dry portions of the study area. Cattail, bulrush, and burreed were more abundant where soil moisture was returned throughout the drawdown. Rice cutgrass and mannagrasses were generally distributed. Waterfowl utilization of the area increased in late summer 1959. Abundant food attracted ducks, and increased cover caused increased use by breeding waterfowl in 1960. Soil and water analyses indicated a definite increase in plant nutrients, especially soil nitrates due to aerobic nitrification. Invertebrate populations were considerably reduced after the drawdown. (Otello-Mass)
W80-00315

MINNESOTA PEAT PROGRAM: MANAGEMENT GOALS AND OBJECTIVES AND POLICY ALTERNATIVES.
For primary bibliographic entry see Field 6A.
W80-00316

PEATLAND POLICY STUDY,
Minnesota Univ.-Duluth.
For primary bibliographic entry see Field 6E.
W80-00317

NITROGEN DYNAMICS AND MODELING IN A FRESHWATER WETLAND,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 2K.
W80-00327

INSTALLATION AND OPERATION OF THE DEE TELEMETRY SYSTEM,
Welsh National Water Development Authority, Cardiff (Wales).
For primary bibliographic entry see Field 7B.
W80-00332

CAPITAL AND OPERATING COSTS OF THE EXISTING DEE RADAR, TELEMETRY AND FLOW FORECASTING PROJECT,
Water Resources Board, Reading (England).
For primary bibliographic entry see Field 7B.
W80-00333

REAL-TIME CONVERSION OF RAINFALL TO RUNOFF FOR FLOW FORECASTING IN THE RIVER DEE,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W80-00334

CONTROL RULES FOR LONG AND SHORT TERM OBJECTIVES,
Welsh National Water Development Authority, Chester (England).
For primary bibliographic entry see Field 2E.
W80-00335

ORGANOCHLORINE INSECTICIDES AND PCB IN SURFICIAL SEDIMENTS (1968) AND SEDIMENT CORES (1976) FROM LAKE ONTARIO,
Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.
For primary bibliographic entry see Field 5A.
W80-00341

MASS EXCHANGE BETWEEN HAMILTON HARBOUR AND LAKE ONTARIO,
Ontario Ministry of the Environment, Toronto. Water Resources Branch.
B. Kohli.
Journal of Great Lakes Research, Vol. 5, No. 1, p 36-44, 1979. 10 fig, 5 tab, 16 ref.

Descriptors: *Mass transfer, *Harbors, *Lakes, *Lake Ontario, Currents(Water), Flow, Dissolved oxygen, Dissolved solids, Water temperature, Canals, Inlets(Waterways), Circulation, Water circulation, On-site investigations, Measurement, Current meters, Temperature, Data processing, Limnology.

The mass exchange between Hamilton Harbour and Lake Ontario waters through the Burlington Canal is important for estimating the dissolved oxygen budget of the harbor. Lake-harbor exchange is caused by either the oscillatory flow in the canal during isothermal conditions or the densimetric flow during thermal stratification. During the study period (September 1975), the canal water was found to be quasi-isothermal; consequently, oscillatory flow existed. A computational method was developed to estimate the exchange based on excursion distance travelled for each limnological episode, and the final flow in each direction was checked with dissolved solids budget. An average of 2,040,000 cu m/d (24 cu m/s) of harbor water is estimated to flow into the lake, while 730,000 cu m/d (8 cu m/s) of lake water flowed toward the harbor during September 1975. This accounts for

the total and net daily exchange of 0.98% and 0.48% of harbor volume, with net exchange being toward the lake. The total and net exchanges were, respectively, 8 and 4 times the natural drainage during the study period. On a monthly average, more water leaves than enters the harbor. The lake-harbor exchange is considered important for maintaining and even improving the existing harbor water quality. The harbor dilution factor was estimated as 0.0019 per day for the present study. (Sims-ISWS)
W80-00343

RELATIVE ACCURACY OF CONNECTING CHANNEL DISCHARGE DATA WITH APPLICATION TO GREAT LAKES STUDIES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2E.
W80-00347

INFLUENCE OF NEARSHORE TILL LITHOLOGY ON LATERAL VARIATIONS IN COASTLINE RECESSION RATE ALONG SOUTHEASTERN LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W80-00348

2I. Water In Plants

CONTRIBUTION TO THE STUDY OF SOME BRYOASSOCIATIONS OF THE SUBALPINE ZONE IN THE SOUTHEAST OF FRANCE (CONTRIBUTION A L'ETUDE DE QUELQUES BRYOASSOCIATIONS DE L'ETAGE SUBALPINE DANS LE SUD-EST DE LA FRANCE),
Centre National de la Recherche Scientifique, Marseille (France). Lab. de Botanique.
J. P. Hebrard.
Vegetatio, Vol. 27, No. 4-6, p 347-381, June 28, 1973. 10 tab, 67 ref.

Descriptors: *Bogs, *Vegetation, *Ecological distribution, Mountains, France, Wetlands, Ecology, Mosses, Peat.

Descriptions are provided of the various vegetative associations found on siliceous rocks, oozing gneiss walls, and calcareous rocks in the subalpine district of the high mountains of southern France. The peat-bogs with Sphagnum spp. and members of the genera aulacomnium and meesea seem to be particular to the old crystalline chain where they were found at an altitude of 1900 meters. Calcareous or flysch-bogs present a cryptogamic vegetative association. (Howard-Mass)
W80-00006

WATER RELATIONS OF THREE MANGROVE SPECIES IN SOUTH FLORIDA,
San Diego State Univ., CA. Dept. of Biology.
P. C. Miller, J. Hom, and D. K. Poole.
Oecologia Plantarum, Vol. 10, No. 4, p 355-367, 1975. 4 fig, 1 tab, 34 ref.

Descriptors: *Mangrove swamps, *Plant physiology, *Moisture deficit, Wetlands, Metabolism, Osmotic pressure, Water balance, Turgidity.

Water potentials measured with a pressure bomb were similar to those measured with thermocouple psychrometers in Avicennia germinas and Laguncularia racemosa but not in Rhizophora mangle at high water potentials. Total lead potentials decreased rapidly with increasing water deficit in Avicennia, more gradually in Laguncularia and after some delay in Rhizophora. Osmotic potentials decreased, as water deficit increased, more rapidly in Avicennia than the others. Turgor potentials decreased rapidly in increasing water deficit in Avicennia, more gradually in Laguncularia and after a delay in Rhizophora. All three mangroves showed a small change in water deficit of branches at relatively high water potentials, a large change at intermediate potentials, and a small change at low potentials, but the pattern varied among the species. Leaf conductance to water loss decreased more rapidly in Avicennia than in Laguncularia. Conductance of Rhizophora increased as relative water deficit increased to 3% to 4%, then decreased. Minimum conductances in the field were 0.2 to 0.5 cm/sec. The differences in water relations are suggested to be related to the differences in mechanisms of salt balance and leaf morphology. (Steiner-Mass)
W80-00009

COMPARATIVE ECOLOGICAL REQUIREMENTS OF A PERENNIAL AND AN ANNUAL SALICORNIA SPECIES: GERMINATION AND GROWTH DURING THE EARLY STAGES OF DEVELOPMENT, (IN FRENCH),
Centre National de la Recherche Scientifique, Montpellier (France). Centre d'Etudes Phytosociologiques et Ecologiques Louis-Emberger.
M. Grouzis.
Oecologia Plantarum, Vol. 8, No. 4, p 367-375, 1973. 3 fig, 16 ref. (English summary).

Descriptors: *Salicornia, *Germination, *Halophytes, Marsh plants, Distribution patterns, Plant growth, Vegetation establishment, Seeds, Salt tolerance.

Two halophytes, widely spread over the French Mediterranean coastal zone, Salicornia emerici and Salicornia fruticosa, have adopted different evolutionary strategies. S. emerici is annual and colonizes the bare silt surfaces where every year numerous seedlings are observed. S. fruticosa is perennial and develops a dense persistent vegetation cover characteristic of a mature ecosystem. This species also produces numerous seeds, but seedlings are found only occasionally. Studies were made under laboratory conditions of the effects of pretreatment of the seeds on germination and of salinity of the substrate on growth during the early stages of development. Results show that salinity of the substrate inhibits seed germination in S. emerici, but not in S. fruticosa. Cold treatment in humid air is not required either for germination in the latter species. At the same time, the two species respond in a similar manner to salinity during the early stages of growth. Therefore, scarceness of S. fruticosa seedlings seems not to be related to some intrinsic property of the seed. (Steiner-Mass)
W80-00010

SEASONAL CHANGES OF PHRAGMITES COMMUNIS TRIN. PART I. GROWTH, MORPHOMETRICS, DENSITY AND BIOMASS,
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
H. Mochnacka-Lawacz.
Polskie Archiwum Hydrobiologii, Vol. 21, No. 3/4, p 355-368, 1974. 7 fig, 2 tab, 20 ref.

Descriptors: *Marsh plants, *Growth rates, *Biomass, Wetlands, Lakes, Distribution patterns, Density, Plant growth, Plant morphology.

During two vegetation seasons the growth rates, morphometrics, density, and biomass of five reedbeds on lakes near Mikolajki, Poland, were compared. Besides the differences between the reedbeds, large differences were also found between reed growing on the shore, in the middle, and on the edge of the reedbeds. In this connection, the reedbeds were classified into three types: undifferentiated, differentiated in one direction, and irregularly differentiated. It was found that the reeds growing in the shore parts of the reedbeds, only periodically inundated with water, were characterized by the lowest values of the variables measured. (Steiner-Mass)
W80-00011

COMMUNITY PLANKTON RESPIRATION IN A SALT MARSH ESTUARY AND THE IMPORTANCE OF MACROPHYTIC LEACHATES,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. E. Turner.
Limnology and Oceanography, Vol. 23, No. 3, p 442-451, May, 1978. 7 fig, 4 tab, 37 ref.

Descriptors: *Salt marshes, *Plankton, *Respiration, Rooted aquatic plants, Biological communities, Temperature, Salinity, Water levels, Seasonal, Fluctuation, Estuary, Wetlands, Marshes, Organic matter, Leaching, Biomass, Georgia.

Community plankton respiration (CPR) in a Georgia salt marsh tidal creek and estuary ranged from 94 to 162 g O2/cu m/year inshore. Values were much lower in nearby coastal waters. Seasonal changes in CPR are closely associated with changes in temperature in a log-log manner as are many other measures of metabolic activity in the estuary, including live biomass of Spartina alterniflora. Leaching rates of dissolved organic matter by Spartina during tidal submergence were 200 to 800 micro g C/g dry wt/h depending on salinity and season. The release rate was lower, 21 micro g C/g dry wt/h, when the plant was not submerged. The plankton community is capable of rapidly and efficiently absorbing this material, which is produced in large enough quantities to account for the observed seasonal changes in CPR. (Howard-Mass)
W80-00014

NITROGEN FIXATION BY RHIZOSPHERE AND FREE-LIVING BACTERIA IN SALT MARSH SEDIMENTS,
Woods Hole Oceanographic Inst., MA.
J. M. Teal, I. Valiela, and D. Berlo.
Limnology and Oceanography, Vol. 24, No. 1, p 126-132, January, 1979. 5 fig, 2 tab, 18 ref.

Descriptors: *Salt marshes, *Sediments, *Bacteria, *Nitrogen fixation, Microenvironment, Microorganisms, Nitrogen cycle, Marshes, Wetlands, Ecology, Root zone, Temperature, Vegetation, Ecological distribution, Biological communities.

The rates of nitrogen fixation by rhizosphere and free-living bacteria are highest near the surface of a variety of salt marsh sediments and in the warm part of the year. The highest rates were found in vegetated habitats, reaching up to about 500 ng N.cm(-2).h(-1). Bacterial N2 fixation for the entire marsh is more than 10 times larger than algal fixation and less than a third of the N required to support growth of the vegetation. (Howard-Mass)
W80-00016

AN EVALUATION OF METHODS FOR ESTIMATING THE NET AERIAL PRIMARY PRODUCTIVITY OF ESTUARINE ANGIOSPERMS,
Georgia Univ., Brunswick. Marine Resources Extension Center.
R. A. Linthurst, and R. J. Reimold.
Journal of Applied Ecology, Vol. 15, No. 3, p 919-931, December, 1978. 1 fig, 4 tab, 25 ref.

Descriptors: *Salt marshes, *Rooted aquatic plants, *Productivity, *Methodology, Estuarine environment, Wetlands, Estimating, Analytical techniques, Primary productivity, Biomass, Standing crop.

Estimated net aerial primary productivity (NAPP) of angiosperms species in coastal saltmarshes of the eastern United States varied up to tenfold when five different harvest methods were utilized. NAPP was underestimated by four methods and may have been overestimated by the remaining method. The ranking of species by NAPP, which may be used as a measure of their importance to the estuarine system, varied between methods. Morphology of the species, location, and general environmental conditions affect the results of any single method. The factors must be considered before selecting a particular harvest method. Future work should assess the precision of the methodologies. (Howard-Mass)
W80-00017

GROWTH AND SALT ACCUMULATION IN TWO ANNUAL SPECIES OF SALICORNIA FROM THE MEDITERRANEAN COAST, (IN FRENCH),
Centre National de la Recherche Scientifique, Montpellier (France). Dept. de Physiologie Ecologique.

M. Grouzis, G. Heim, and A. Berger.
Oecologia Plantarum, Vol. 12, No. 4, p 307-322, 1977. 9 fig, 3 tab, 31 ref. (English summary).

Descriptors: *Salicornia, *Halophytes, *Salt tolerance, Wetlands, Plant growth, Seashores.

Growth and salt accumulation were studied in two annual species of Salicornia living in contrasting ecological situations. Salicornia patula is found on heavy soils where salinity is very high while Salicornia brachystachya grows on coarser soils where the level of salinity is much lower. Results show that the two species are obligatory halophytes requiring a certain salt concentration to attain full development. Comparison between their responses to salinity indicates that they differ more in their requirement in salt than by their resistance to it and their roots are less sensitive than their aerial parts to an excess as well as a lack of salt. (Steiner-Mass)
W80-00018

ADSORPTION AND ACCUMULATION OF PESTICIDES RESIDUES AND CHLORINATED BIPHENYLS IN BOTH WILD AQUATIC VEGETATION AND RICE IN THE CAMARGUE REGION, (IN FRENCH),
Centre National de la Recherche Scientifique, Arles (France). Centre Ecologie Camargue.
For primary bibliographic entry see Field 5B.
W80-00020

ROLE OF CARBOHYDRATE IN HALOPHYTES OF THE REGION OF NEUSIEDLER LAKE, AUSTRIA, (IN GERMAN),
Vienna Univ. (Austria). Pflanzenphysiologisches Inst.
R. Albert, and M. Popp.
Oecologia Plantarum, Vol. 13, No. 1, p 27-42, 1978. 4 fig, 2 tab, 48 ref. (English summary).

Descriptors: *Halophytes, *Plant physiology, *Carbohydrates, *Lake Neusiedler(Austria), Wetlands, Marsh plants, Monocots, Dicots, Plant tissues, Osmotic pressure, Lakes.

The total sugar concentrations in the cell sap of monocotyledons ranged from 154 to 213 mmol./liter freshwater and far exceeded the concentrations in dicotyledons, 19 to 85 mmol./liter. Except for pronounced salt-accummulators (Salicornia, Suaeda, Lepidium crassifolium, Triglochin maritimum) the total osmotic potentials, calculated from the sum of soluble ions and carbohydrates, lie as low in monocotyledons as in most dicotyledons (-13 to -22 bars, average) in spite of restricted salt uptake of former species. Accordingly, in monocotyledons the percentages of soluble carbohydrates of the total osmotic potentials are as high as 25 to 36% while dicotyle halophytes were as low as 2 to 12%. The high sugar content of monocotyle species is considered to be of eco-physiological importance, since it makes possible the growth of such plants on saline soils having low water potential without extensive salt accumulation. (Steiner-Mass)
W80-00021

THE INFLUENCE OF SALINITY, INUNDATION AND TEMPERATURE ON THE GERMINATION OF SOME HALOPHYTES AND NON-HALOPHYTES,
Vrije Univ., Amsterdam (Netherlands). Biological Lab.
J. Rozema.
Oecologia Plantarum, Vol. 10, No. 4, p 341-353, 1975. 3 fig, 29 ref.

Descriptors: *Marsh plants, *Salt tolerance, *Flooding, Wetlands, Ecological distribution, Salt marshes, Marsh management, Germination, Marshes, Halophytes.

The germination responses of some plant species from a Dutch salt marsh were tested in regard to salinity and flooding. A comparison was made between these species and some inland glycophytes. Juncus maritimus was the most salt tolerant species. Juncus gerardii preferred flooding conditions for the germination as, to less extent, all investigated Juncus species. However, differences in salt and flooding response between the investigated halophytes and glycophytes are relatively small. Plant zonation can only partly be explained by the factors of salinity and flooding regarding germination. (Steiner-Mass)
W80-00022

SEASONAL PATTERNS OF CO2 AND WATER VAPOR EXCHANGE OF JUNCUS ROEMERIANUS SCHEELE IN A GEORGIA SALT MARSH,
Georgia Univ., Athens. Dept. of Botany.
J. R. Giurgevich, and E. L. Dunn.
American Journal of Botany, Vol. 65, No. 5, p 502-510, May-June, 1978. 3 fig, 4 tab, 40 ref.

Descriptors: *Salt marshes, *Vegetation, *Plant physiology, Productivity, Photosynthesis, Carbon cycle, Transpiration control, Respiration, Microenvironment, Environmental effects, Temperature, Georgia, Seasonal, Wetlands, Ecology.

Net photosynthesis in intact plants of Juncus roemerianus (black needle-rush) in an undisturbed salt marsh community on Sapelo Island, Georgia, was highest in early spring, but declined only slightly through the year. A district and moderate temperature optimum of net photosynthesis was observed with decreasing rates above 30 C. Leaf conductances to water vapor were similar at all seasons and were high at cooler temperatures and decreased with increasing temperature. Transpiration was relatively high and constant during all seasons. The water-use efficiency of photosynthesis was high below 25 C, but decreased sharply above that temperature. Dark respiration was relatively low. Seasonal changes reflected changes in leaf density. Decreasing stomatal conductances and increasing respiration rates reduced net photosynthesis at higher temperatures. The stomatal resistance increased and internal resistances to CO2 uptake decreased over the year, but the total resistance remained constant. The internal resistance to CO2 uptake was consistently higher than stomatal resistance. Juncus roemerianus is well adapted to the seasonal changes in ambient temperature, irradiance and other microenvironmental factors of the high marsh, and can maintain a high productivity in the seasonally hot and stressful environment. (Howard-Mass)
W80-00023

THE MINERAL CONTENT OF SPHAGNUM FUSCUM AS AFFECTED BY HUMAN SETTLEMENT,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
E. Gorham, and D. L. Tilton.
Canadian Journal of Botany, Vol. 56, No. 21, p 2755-2759, November 1, 1978. 1 fig, 5 tab, 21 ref.

Descriptors: *Bogs, *Nutrients, *Mosses, *Agriculture, *Environmental effects, Chemical properties, Marshes, Wetlands, Freshwater marshes, Ecology, Minnesota, Aquatic plants.

Windblown soil from cultivated farmland is the chief influence upon the ash content of Sphagnum fuscum in ombrotrophic bogs, which are dependent upon the atmosphere for their mineral supply, in Minnesota, Wisconsin, and Saskatchewan. Bogs unaffected by human settlement and the resultant increase in the mineral supply are restricted to the wilderness areas in the northeastern part of Minnesota. Sphagnum serves as an effective trap for dust fall and is much richer in the lithophile elements Al and Fe than the needles of tamarack from comparable habitats. Dust fall may be readily washed off the tree needles by rain. Tamarack concentrates B to a much greater degree than does Sphagnum. (Howard-Mass)
W80-00024

PRIMARY PRODUCTIVITY OF EMERGENT MACROPHYTES IN A WISCONSIN MARSH ECOSYSTEM,
Wisconsin Univ.-Milwaukee. Dept. of Botany.
J. M. Klopatek, and F. W. Stearns.
American Midland Naturalist, Vol. 100, No. 2, p 320-332, 1978. 3 fig, 5 tab, 52 ref.

Descriptors: *Freshwater marshes, *Marsh plants, *Primary productivity, Wetlands, Marshes, Cattails, Seasonal, Marsh management, Standing crop, Mud flats, Rooted aquatic plants, Aquatic plants.

Primary productivity of various emergent macrophytes was examined in Theresa Marsh, a shallow, semimanaged impoundment in southeastern Wisconsin. Dominant macrophytes included Typha latifolia, Scirpus fluviatilis, Carex lacustris, Phalaris arundinacea, and a shrub, Salix interior. Seasonal patterns of production as well as total production varied greatly among species. With estimates for litter loss and below-ground production, annual net primary production ranged from 1181 g/sq m/year for Carex lacustris to nearly 3200 g/sq m/year for Typha latifolia. Peak standing crop values were generally among the highest reported. Average productivities during the growing season, however, were relatively low, ranging from 6.31 to 10.52 g/sq m/year for aboveground standing crops. Primary production was also estimated for transient species that occurred on mud flats following a marsh drawdown. The high primary production within the marsh appears to be based on high nutrient levels as indicated by the marsh water and soil chemistry. (Steiner-Mass)
W80-00026

FLORISTICS OF THE MIDDLE MISSISSIPPI RIVER SAND AND MUD FLATS,
Marshall Univ., Huntington, WV. Dept. of Biological Sciences.
D. K. Evans.
Castanea, Vol. 44, No. 1, p 8-24, 1979. 4 fig, 4 tab, 13 ref.

Descriptors: *Mississippi River, *Distribution patterns, *Marsh plants, Rivers, Mud flats, Sand bars, Aquatic plants, Rooted aquatic plants, Illinois, Missouri, Wetlands.

Collections of vascular plants from nine study stations along the middle Mississippi River sand and mud flats in southern Illinois and southeastern Missouri were made over three growing seasons. Of 187 taxa recorded, the Graminae, Eupharbiaceae, Compositae, and Cypernaceae were, respectively, the most widespread and abundant groups. Floristic similarity coefficients of nine sites along 30 miles of shoreline ranged from 0.189 to 0.803. Line transects through representative communities indicated that six to seven species comprised 83 to 87 percent of the total relative frequencies of species encountered. Composition and distribution of river flat flora are greatly influenced by proximity of seed source, site habitat diversity, frequency and season of flooding, and chance dispersal of disseminules by water. (Steiner-Mass)
W80-00028

EMERGENT AQUATIC PLANTS IN THE UPPER OHIO RIVER AND MAJOR NAVIGABLE TRIBUTARIES, WEST VIRGINIA AND PENNSYLVANIA,
Army Engineer District, Pittsburgh, PA.
M. Koryak.
Castanea, Vol. 43, No. 4, p 228-237, 1978. 1 fig, 2 tab, 9 ref.

Descriptors: *Ohio River, *Distribution patterns, *Aquatic plants, Rivers, Aquatic habitats, Rooted aquatic plants, Submerged plants.

A cursory examination was made of aquatic macrophyte distribution along the length of the Monongahela River, a 210 kilometer reach of the upper Ohio River, and the lower 116 kilometers of the Allegheny River where commercial navigation is maintained. Aquatic vascular plants were abundant and diverse in both the rivers. Significant qualitative differences were observed in the aquatic macroflora that may be related to basic differences in the channel morphologies and the substrates of these two rivers. Aquatic plants, at least conspicuous emergent vegetation, were not abundant in the reach of the mainstream Ohio River that was examined. (Steiner-Mass)
W80-00029

BEACH AND SALT MARSH VEGETATION OF THE NORTH AMERICAN PACIFIC COAST,
California Univ., Santa Barbara. Dept. of Geological Sciences.
K. B. Macdonald, and M. G. Barbour.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.) Academic Press, Inc., New York, p 175-233, 1974. 4 fig, 9 tab, 100 ref.

Descriptors: *Marsh plants, *Halophytes, *Distribution patterns, *Pacific coast region, Wetlands, Salt marshes, Marshes, Beaches, Aquatic plants, Coastal marshes.

Some 57 species of vascular plants appear to be most characteristic of the beaches from Point Barrow, Alaska, to the tip of Baja California while over 140 species of vascular plants and a dozen macro-algae species are characteristic of the salt marshes. Species range data indicate that the composition of the salt marsh changes rather gradually with latitude and that the species represented at each locality characteristically occupy discrete vertical zones. Quantitative data indicate that while each species may reach its maximum abundance over a limited elevational range, it will also occur in lesser abundances in other elevational zones under different environmental conditions. There is also some evidence to suggest that while the more northerly marshes may be separated into high and low marsh vegetation types, the more southerly sites may contain a third distinctive vegetation type that is restricted to intermediate elevations. (Steiner-Mass)
W80-00031

A REVIEW OF STRUCTURE IN SEVERAL NORTH CAROLINA SALT MARSH PLANTS,
North Carolina State Univ. at Raleigh. Dept. of Botany.
C. E. Anderson.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.). Academic Press, Inc., New York, p 307-344, 1974. 39 fig, 25 ref.

Descriptors: *Marsh plants, *Halophytes, *North Carolina, *Plant morphology, Wetlands, Vascular tissues, Salt marshes, Plant tissues, Marshes, Grasses, Salt tolerance, Structure.

The basic structural features are presented of seven plants occurring in North Carolina salt marshes. The plants are: Spartina alterniflora, Spartina patens, Distichlis spicata, Aster tenuiflolius, Juncus roemerianus, Salicornia virginica, and Limonium spp. Literature on related species are also presented. (Steiner-Mass)
W80-00032

SALT TOLERANCE OF MANGROVES AND SUBMERGED AQUATIC PLANTS,
Texas Univ. at Austin. Plant Ecology Research Lab.
C. McMillan.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.). Academic Press, Inc., New York, p 379-390, 1974. 3 tab, 23 ref.

Descriptors: *Mangrove swamps, *Submerged aquatic plants, *Salt tolerance, Wetlands, Swamps, Halophytes, Aquatic plants, Marine plants, Salinity.

Mangroves and submerged aquatic plants share a niche attribute of tolerance to broad and rapid changes in salinity. Among five seagrasses studied, Halodule, which often occurs as the sole occupant of shallower and more hypersaline bays, has the greatest tolerance of salinity. Cymodocea and Halophila have the narrowest tolerance ranges, and Ruppia is the only one that can survive for extended periods in nonsaline conditions. In order of their decreasing tolerance to low salinity, the five seagrasses are: Ruppia, Halodule, Thalassia, Cymodocea, and Halophila. The mangroves also survived rapid changes in salinity but among three species studied, narrower tolerances were shown by Rhizophora and Laguncularia than by Avicenna. All survive for indefinite periods in nonsaline conditions. Among Avicenna plants, those of various age or stage of development showed different salt tolerance. Seedlings and younger plants had greater tolerance to hypersaline conditions. (Steiner-Mass)
W80-00033

MATHEMATICAL MODELING--SPARTINA,
Georgia Univ., Sapelo Island. Marine Inst.
R. J. Reimold.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.). Academic Press, Inc., New York, p 393-406, 1974. 7 fig, 3 tab, 34 ref.

Descriptors: *Marsh plants, *Mathematical models, *Phosphorus, Wetlands, Salt marshes, Grasses, Model studies, Marsh management, Halophytes.

A five compartment mathematical model is presented to examine discrete changes in Spartina alterniflora, the salt marsh cordgrass. A portion of the research focused on mathematical manipulation of the model, the other on field validation of the mathematical manipulation. The initial results of the model over four years demonstrate that there is a periodicity in each of the compartments and that it assumes a logical sequence. An increase in phosphorus in Spartina is followed by an increase in the detritus and water compartments. The sediment compartment contains most of the standing stock of phosphorus and gives the stability to the rest of the system. (Steiner-Mass)
W80-00034

PROBABLE AGENTS FOR THE FORMATION OF DETRITUS FROM THE HALOPHYTE, SPARTINA ALTERNIFLORA,
Brunswick Junior Coll., GA.
M. S. May, III.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.). Academic Press, Inc., New York, N.Y., p 429-440, 1974. 4 fig, 18 ref.

Descriptors: *Marsh plants, *Detritus, *Marine fungi, Wetlands, Salt marshes, Marshes, Halophytes, Grasses, Bacteria, Isopodes, Invertebrates, Decomposing organic matter.

Scanning electron microscopy was used as a tool for observing in situ microbial organisms during the sequential degradation of Spartina alterniflora culms in litter bags placed in a salt marsh. Other work included an examination of the detritus producing role of Cleantis planicauda, an estuarine isopod, and several other macro-invertebrates associated with dead Spartina alterniflora. Results showed that microbial decomposition of dead Spartina to detritus does occur and is probably due to fungi and that macroinvertebrates, especially Cleantis planicauda are major degraders of dead Spartina to detritus. (Steiner-Mass)
W80-00036

REMOTE SENSING AS A TOOL FOR STUDYING THE ECOLOGY OF HALOPHYTES,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 7B.
W80-00037

RELATIONSHIP OF VERTEBRATES TO SALT MARSH PLANTS,
Georgia Univ., Sapelo Island. Marine Inst.
G. F. Shanholtzer.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.). Academic Press, Inc., New York, p 463-474, 1974. 4 fig, 2 tab, 16 ref.

Descriptors: *Salt marshes, *Wildlife, *Fish, *Marsh plants, Wetlands, Marshes, Halophytes, Birds, Water birds, Nesting, Wildlife habitat, Mammals, Spatial distribution, Nutrient cycling.

Significant salt marsh plant-vertebrate relationships exist in areas subject to tidal-saline waters. Their associations assume both direct and indirect dimensions. Direct relationships involve spatial and physical utilization of the plants. Spatial utilization patterns are derived from the territory, home range, and behavior of the species using the marsh, and the structure of the plants themselves. Marsh vegetation provides a habitat volume and structural foundation for feeding, reproductive, and roosting activities. Plant cover additionally provides a moderated thermal environment and refuge from predation. Thermal considerations are important during periods of avian incubation when excessive solar radiation can damage eggs and young. Indirect relationships usually involve nutrient and material cycling in the marsh and dispersal of halophyte seeds. (Steiner-Mass)
W80-00038

NUTRIENT LIMITATION IN SALT MARSH VEGETATION,
Boston Univ. Marine Program, Woods Hole, MA. Marine Biological Lab.
I. Valiela, and J. M. Teal.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.). Academic Press, Inc., New York, p 547-563, 1974. 6 fig, 4 tab, 20 ref.

Descriptors: *Salt marshes, *Marsh plants, *Plant growth, *Fertilizers, Wetlands, Marshes, Grasses, Marsh management, Nutrients, Standing crop, Nitrogen, Ureas, Phosphates, Halophytes.

Fertilization with urea and phosphate produced significant increases in dissolved NH4N and PO4P, respectively, in the sediment water of treated salt marsh plots. Standing crops of marsh plants increased in the urea-fertilized plots while the standing crop in swards undergoing phosphate enrichments resembled control standing crops. This response pattern held for total aboveground vegetation and for individual standing crops of Spartina alterniflora, Spartina patens, and Distichlis spicata. Nitrogen supply therefore is one of the most important limiting factors for salt marsh vegetation. Preliminary results suggest, however, that roots and rhizomes will not show an increase in standing crops in response to fertilization with either phosphorus or nitrogen. The urea enrichments also resulted in a general increase in nitrogen content of aboveground plant tissues, roots, and rhizomes. The increased standing crops and nitrogen contents of aboveground plant parts may be an important source of nitrogenous organic materials exported from salt marshes to nitrogen poorer estuarine waters, particularly where the salt marsh is subject to nitrogen enrichment. (Steiner-Mass)
W80-00039

THE POTENTIAL ECONOMIC USES OF HALOPHYTES,
Scrippts Institution of Oceanography, La Jolla, CA. Foundation for Ocean Research.
For primary bibliographic entry see Field 6C.
W80-00040

CORRELATION OF APALACHICOLA RIVER FLOODPLAIN TREE COMMUNITIES WITH WATER LEVELS, ELEVATION, AND SOILS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
H. M. Leitman.
M.S. Thesis, August, 1978. 57 p, 7 fig, 8 tab, 30 ref, 4 append.

Descriptors: *Floodplain, *Trees, *Ecological distribution, *Florida, Swamps, Willow trees, Wetlands, Soils, Water levels, Rivers, Vegetation, Hydrogen ion concentration, Cation exchange, Elevation.

Three major floodplain tree communities were identified at two study sites on the Apalachicola River: Taxodium distichum--Nyssa aquatica in deep swamps, Salix nigra on point bars, and mixed bottomland hardwoods on flats and levees. Actual percent inundation was difficult to determine from river stage data because of residual water held on the floodplain and because of differences in the water holding capacity of the soils. Ground elevations within the floodplain were correlated with the various stages of the river, and this elevation-stage height correlation was a more practical indicator of community types than actual percent inundation. Soil types also correlated with major community types. (Stihler-Mass)
W80-00041

Field 2—WATER CYCLE

Group 2I—Water In Plants

NUTRITIVE VALUE OF DRIED OR ENSILED AQUATIC PLANTS. I. CHEMICAL COMPOSITION,
Minnesota Univ., St. Paul. Dept. of Animal Science.
J. G. Linn, E. J. Staba, R. D. Goodrich, J. C. Meiske, and D. E. Otterby.
Journal of Animal Science, Vol. 41, No. 2, p 601-609, August, 1975. 7 tab, 15 ref.

Descriptors: *Aquatic plants, *Nutrients, *Chemical analysis, Rooted aquatic plants, Fibers, Feeds, Livestock, Drying, Acids, Fermentation, Calcium, Phosphorus, Proteins, Silage, Alfalfa, Corn, Hydrogen ion concentration, Ruminants.

Chemical analyses of 21 species of dried aquatic plants indicated they contain sufficient quantities of nutrients to be considered as livestock feedstuffs. Although considerable variation existed among the 21 species, 14 species contained more than 10% protein and all species contained less than 30% crude fiber. Lactic acid values and pH values were determined for fermented mixtures of ensiled aquatic plants, corn, and alfalfa. (See also W80-00299) (Bollinger-Mass)
W80-00298

NUTRITIVE VALUE OF DRIED OR ENSILED AQUATIC PLANTS. II. DIGESTIBILITY BY SHEEP,
Minnesota Univ., St. Paul. Dept. of Animal Science.
J. G. Linn, R. D. Goodrich, D. E. Otterby, J. C. Meiske, and E. J. Staba.
Journal of Animal Science, Vol. 41, No. 2, p 610-615, August, 1975. 5 tab, 10 ref.

Descriptors: *Aquatic plants, *Forage palatability, *Sheep, *Digestion, Rooted aquatic plants, Livestock, Ruminants, Metabolism, Drying, Nutrients, Feeds, Forages, Protein, Nitrogen, Energy conversion, Hydrogen ion concentration, Acids, Fermentation.

Palatability of aquatic plants may be a limiting factor in their use as a forage for ruminants. Drying or ensiling did not appear to be satisfactory procedures for improving palatability. Digestibility in lambs of two dried aquatic plants and an ensiled mixture of aquatic plants was compared with that of alfalfa and corn on the basis of dry matter, crude proteins, energy, and nitrogen. Rumen fluid pH and acetic propionic acid ratio were also compared in lambs fed the different diets. (See also W80-00299) (Bollinger-Mass)
W80-00299

PLANTS AND ANIMALS OF THE ESTUARY.
For primary bibliographic entry see Field 2L.
W80-00300

PLANT LIFE OF THE ESTUARY,
Connecticut Coll., New London.
For primary bibliographic entry see Field 2L.
W80-00301

EFFECTS OF MALATHION ON MICROORGANISMS OF AN ARTIFICIAL SALT-MARSH ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
A. W. Bourquin.
Journal of Environmental Quality, Vol. 6, No. 4, p 373-378, October-December, 1977. 4 fig, 1 tab, 16 ref.

Descriptors: *Salt marsh, *Environmental effects, Artificial environment, Wetlands, Microorganisms, *Malathion, Ecosystems, Organophosphate insecticide, *Microbial-pesticide interaction, *Effects of pesticides, Degradation, Microbial activities, Mirex.

Laboratory salt-marsh environments were treated with malathion, an organophosphate insecticide, and aerobic heterotrophic bacteria were monitored to determine changes in their microbial ecology. Several physiological activities were assayed in both treated and untreated controls; however, no reliable trends in numbers of these microorganisms were detected. On the other hand, populations of malathion sole-carbon-degrading bacteria increased significantly with increasing treatment levels and in the sediments with repeated treatment. Malathion cometabolizing bacteria increased significantly over the control systems in the water column with increasing treatment levels. Although numbers of malathion-degrading bacteria increased with higher treatment levels or frequency of treatment, these changes had no effect on the total number of bacteria from the water or sediment. When an organochlorine insecticide, mirex, was used to treat the ecosystems, essentially no changes in the bacterial populations were detected. (Hinkel-Mass)
W80-00303

CALORIC, ELEMENTAL, AND NUTRITIVE CHANGES IN DECOMPOSING JUNCUS ROEMERIANUS LEAVES,
Mississippi State Univ., Mississippi State. Dept. of Zoology.
A. A. de la Cruz, and B. C. Gabriel.
Ecology, Vol. 55, No. 4, p 882-886, Summer, 1974. 2 fig, 4 tab, 20 ref.

Descriptors: *Decomposing organic matter, *Marshes, Proteins, Carbon, Nitrogen, Energy, Rooted aquatic plants, Wetlands.

In situ decomposition rate of Juncus roemerianus (Juncaceae) leaves determined by litterbag method was 40% per year. Caloric, elemental, and proximate nutritive analyses of leaves at various stages of life and decay--classified as young, mature, standing dead, partially decayed, decomposed fragments, and particulate detritus--showed the following: (a) an increase in caloric content (4630-4911 g cal/ash-free g); (b) a decrease in carbon (49.75%-6.3%), nitrogen (1.09%-0.57%), and phosphorus (0.22%-0.17%); and (c) a decrease in crude fiber (37%-9%), carbohydrate (52%-11%), protein (9%-4%) and fats (2.0%-0.82%). Particulate detritus retrieved from litterbags decomposed in incubation flasks at the rate of 50% in 36 days. At intervals of 0, 5, 13, 25, and 36 days, analyses of detritus showed the following: (a) a decrease in organic content (67%-32%) and carbon (5.6%-3.2%); and (b) an increase in nitrogen (0.44%-1.21%) and respiration rates (0.11%-1.10 mg O2 hr(-1) ash-free g(-1)). The increase in nitrogen of detritus and consequently protein is attributed to conversion of plant tissue to microbial protoplasm as evidenced by increased respiration rates. (Stihler-Mass)
W80-00307

FACTORS INFLUENCING SHOOT PRODUCTION AND MINERAL NUTRIENT LEVELS IN TYPHA LATIFOLIA,
Savannah River Ecology Lab., Aiken, SC.
C. E. Boyd, and L. W. Hess.
Ecology, Vol. 51, No. 2, p 296-300, Early Spring, 1970. 3 fig, 3 tab, 22 ref.

Descriptors: *Standing crop productivity, *Nutrients, *Swamps, Floodplain, Aquatic plants, Phosphorus, Typha latifolia.

Shoot standing crops for Typha latifolia ranged from 428 to 2,252 g dry wt/sq m. Standing crops were positively correlated with concentrations of dilute acid soluble phosphorus in hydrosoils and dissolved phosphorus in the waters. Except for a weak correlation for dissolved calcium, additional site fertility parameters were not correlated with standing crop. Tissue nutrient levels varied considerably, maximum values for most minerals being three or four times as great as the smallest values. Correlations between environmental levels of several nutrients and tissue concentrations were significant, but not very strong. Tissue concentrations of most nutrients were positively correlated with nitrogen content. Despite variations in tissue levels of nutrients, standing crop was the decisive factor determining quantities of nutrients per unit area of stand. (Hinkel-Mass)
W80-00308

SAMPLING MACRO-ORGANIC MATTER PROFILES IN SALT MARSH PLANT ROOT ZONES,
Georgia Univ., Sapelo Island. Marine Inst.
J. L. Gallagher.
Proceedings of the Soil Science Society of America, Vol. 38, p 154-155, 1974. 1 fig, 1 tab, 3 ref.

Descriptors: *Salt marsh, *Root zones, *Wetland soils, *Marsh plants, Salt marsh plant, Organic matter, Soil cover, Underground aerial biomass ratios, Spartina, Distichlis, Juncus.

A device for sampling the root zones of marsh plants and a method for processing the resulting cores are described. Using these techniques, five stands of marsh plants were sampled and their macro-organic matter profiles compared. The least total macro-organic matter was found in the high vigor Spartina alterniflora Loisel, and the Distichlis spicata (L.) Greene root zones. Within S. alterniflora stands, the macro-organic matter in the soil profile increased as vigor of the aerial portions decreased. Juncus roemerianus Scheele and short form S. alterniflora profiles were similar in shape and had the highest macro-organic matter content. (Hinkel-Mass)
W80-00309

VEGETATION CHANGES IN A SHALLOW AFRICAN LAKE: RESPONSE OF THE VEGETATION TO A RECENT DRY PERIOD,
Rhodes Univ., Grahamstown (South Africa). Inst. for Freshwater Studies.
For primary bibliographic entry see Field 2H.
W80-00313

RESISTANCE OF THE MICROBIAL COMMUNITY WITHIN SALT MARSH SOILS TO SELECTED PERTURBATIONS,
Georgia Univ., Athens. Dept. of Microbiology.
R. R. Christian, K. Bancroft, and W. J. Wiebe.
Ecology, Vol. 59, No. 6, p 1200-1210, Autumn, 1978. 3 fig, 6 tab, 49 ref.

Descriptors: *Salt marshes, *Microorganisms, *Resistance, Aquatic plants, Marsh, Wetlands, Ecology, Aquatic habitats, Nutrients, Georgia, Spartina, Spartina alterniflora, Ecosystems, Ecological distribution.

The response of the soil microbial community to selected long-term perturbations was examined in a Spartina alterniflora salt marsh on Sapelo Island, Georgia. In two perturbation experiments, macrophytic primary production was removed from marsh plots by clipping shoots and pruning beneath ground parts for periods up to 18 months. In a third experiment, monthly enrichments of glucose, ammonium nitrate and their combination were made for five months to both clipped and pruned plots as well as unclipped control plots. The state of the microbial community was monitored by adenosine triphosphate and total adenylate concentrations, community adenylate energy charge ratio and aerobic uptake of C14-glucose by mud slurries. Overall responses were consistent with the hypothesis that the soil microbial community is relatively unlinked to plant growth. This 'unlinking' appears responsible for the observed resistance to change by the microbial community in the face of perturbations to the marsh system. The hypothesis that the microbial community is limited by physiochemical and spatial factors rather than nutrient availability is supported. (Howard-Mass)
W80-00314

EFFECTS OF A DRAWDOWN ON A WATERFOWL IMPOUNDMENT,
Michigan Dept. of Conservation, Lansing. Rose Lake Wildlife Experiment Station.
For primary bibliographic entry see Field 2H.
W80-00315

MANGROVES: A REVIEW,
Environmental Research Lab., Gulf Breeze, FL; and Corvallis Environmental Research Lab., OR. Associate Lab.

G. E. Walsh.
Gulf Breeze Laboratory, Publication No. 154, 1974. 21 fig, 21 tab, 1176 ref.

Descriptors: *Mangrove swamps, *Ecology, *Literature, Wetlands, Swamps, Distribution, Salt tolerance, Halophytes, Ecological distribution, Trees, Plant physiology, Forest management, Herbicides.

A literature review, using over 1,000 references, is presented on the ecology, geographical distribution, and the physiological adaptations of mangroves as well as the silvicultural practices used to manage these areas and effects of herbicides on the trees. (Steiner-Mass)
W80-00319

THE RELATIONSHIP OF MARINE MACROINVERTEBRATES TO SALT MARSH PLANTS,
Georgia Univ., Sapelo Island. Marine Inst.
J. N. Kraeuter, and P. L. Wolf.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.). Academic Press, Inc., New York, p 449-462, 1974. 2 tab, 46 ref.

Descriptors: *Salt marshes, *Marsh plants, *Invertebrates, Wetlands, Marshes, Distribution patterns, Literature, Environmental effects, Aquatic animals, Insects, Isopods, Amphipoda, Gastropods, Halophytes.

A literature review is presented of the types of macroinvertebrates found within salt marshes, the direct and indirect effects of salt marsh plants on the animals, the indirect effects of the animals on the plants, and the environmental parameters affecting the distribution of the animals. (Steiner-Mass)
W80-00321

USE OF PRAIRIE POTHOLE HABITAT BY BREEDING MALLARDS,
Fish and Wildlife Service, Laurel, MD. Migratory Bird and Habitat Research Lab.
T. J. Dwyer, G. L. Krapu, and D. M. Janke.
Journal of Wildlife Management, Vol. 43, No. 2, p 526-531, April, 1979. 4 tab, 13 ref.

Descriptors: *Mallards, *Breeding, *Grasslands, *Freshwater marshes, *Potholes, Wetlands, Ecology, Marshes, Waterfowl, Ponds.

Data from eight paired, marked, mallard hens indicate that a large home range encompassing diverse wetland types is advantageous in the semiarid climate of south central North Dakota. Findings suggest that mallard hens seek out several wetlands to provide breeding requirements before the brood rearing period. Low nest success rates of recent years have placed greater importance on renesting, which further increases hen demands on the wetland environment. Because water levels change rapidly during the nesting season causing marked fluctuations in availability of food, hens must often rely on new foraging sites when attempting to renest. The proximity of numerous wetlands of varying types increases the likelihood that adequate habitat will be present to meet the diverse needs of breeding mallards. (Howard-Mass)
W80-00322

WEED CONTROL METHODS FOR RIVER BASIN MANAGEMENT,
Corps of Engineers, Washington, DC.
E. O. Gangstad.
CRC Press, West Palm Beach, Florida. 1978. 229 p.

Descriptors: *Aquatic plants, *Water hyacinth, *Alligator weed control, Aquatic weeds, Weed control, Rivers, Herbicides, Pesticide residues, Pesticide kinetics, Rooted aquatic plants.

Aquatic plants continue to create problems associated with navigation, flood control, agriculture, irrigation and drainage, land values, wildlife and fisheries conservation, and water resource supply. This volume provides a scientifically documented treatise of the known facts as they apply to the control of aquatic weeds in river basins and their allied waterways and the impacts of the control methods with particular emphasis on alligator weed and water hyacinth. (Steiner-Mass)
W80-00323

SILICA AND ASH IN THE SALT MARSH RUSH, JUNCUS ROEMERIANUS,
Kansas State Univ., Manhattan. Dept. of Chemistry.
F. C. Lanning, and L. N. Eleuterius.
Gulf Research Reports, Vol. 6, No. 2, p 169-172, December, 1978. 2 fig, 2 tab, 10 ref.

Descriptors: *Aquatic plants, *Silica, *Leaves, *Rhizomes, Marshes, Wetlands, Ecology, Rushes, Juncus roemerianus, Mississippi.

Silica content of living rhizomes from the perennial salt marsh rush Juncus roemerianus had values of 0.34, 0.20, and 0.60% of dry weight in three morphologically distinct populations along the Mississippi coast. These values were directly related to available silica content of the soil. Living leaves from the different populations had about the same average silica content. Silica content increased with age in both living leaves and rhizomes, and increased in leaves over the growing season. Decomposed leaves had a relatively high silica content of 1.81%, reflecting a loss of organic matter and soluble materials. Roots contain considerable silica, but reliable results for content were not obtained. Petrographic microscope studies showed that the silica was clear, colorless and isotropic with a refractive index of 1.43, all properties of the mineral opal. The silica was deposited in a sheet made of small, irregular phytoliths arranged in lengthwise rows in the leaves. Ash percentages were much higher than those for silica and no definite conclusions could be drawn from their variation. The maximum silica concentration in leaves of J. roemerianus were relatively low compared to that in leaves of J. interior. (Howard-Mass)
W80-00325

HALOPHYTE SEED GERMINATION,
Ohio Univ., Athens. Dept. of Botany.
I. A. Ungar.
The Botanical Review, Vol. 44, No. 2, p 233-264. April-June, 1978. 5 fig, 2 tab, 167 ref.

Descriptors: *Halophytes, *Seeds, *Germination, *Salt tolerance, Aquatic plants, Wetlands, Ecology, Temperature, Sodium chloride, Resistance, Salts, Stress.

The results of numerous investigations indicate that a continuum of salt tolerance at the germination stage exists from the least tolerant glycophyte to obligate salt marsh species. A delay in seed germination and final reduction in total number of seeds germinated may occur in salt concentrations as low as 0.1% NaCl for the least tolerant species or not until concentrations above 1.0% NaCl for halophytes. Halophyte seeds have the ability to remain dormant at high salinities and then to germinate when salinities are reduced. This recovery in germination indicates that no permanent specific ion toxicity is produced and that the chief influence of excess salts may be osmotic. NaCl is one of the more important salts influencing the distribution of halophytes and has been found to be the least toxic in tests with isotonic solutions. Data indicates the occurrence of synergistic interactions between salinity and temperature on seed germination. Interrelationships between exogenous growth regulator treatments and alleviation of dormancy induced by salt stress has been demonstrated with both glycophytes and halophytes but the mechanism is not understood. More data concerning the behavior of halophyte seeds in nature is necessary for increased understanding of the germination process. (Howard-Mass)
W80-00326

NITROGEN DYNAMICS AND MODELING IN A FRESHWATER WETLAND,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 2K.
W80-00327

BIOGEOCHEMISTRY OF A FORESTED ECOSYSTEM,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
For primary bibliographic entry see Field 4C.
W80-00328

2J. Erosion and Sedimentation

SURFICIAL SEDIMENTS OF SALDANHA BAY AND LANGEBAAN LAGOON,
Cape Town Univ. (South Africa). Dept. of Geology.
G. F. Birch.
Trans. Geological Society of South Africa, Vol. 79, No. 3, p 293-300, 1976. 9 fig, 24 ref.

Descriptors: *South Africa, *Lagoons, *Sediments, *Salt marshes, Wetlands, Geology, Marshes, Geomorphology, Sedimentation, Coast marshes, Marine geology, Geologic investigations.

The marshland areas lying above the mean high water line in Langeboon Lagoon are comprised of non-calcareous, highly organic muddy sediment. These regions are fringed by intertidal sand banks comprising well-sorted medium quartzitic sands, which, in turn, are dissected by deep tidal channels containing coarse sand-size quartz. The sediment contains increasing amounts of coarse quartz towards the western shore of the lagoon. Sediment throughout the study is phosphate poor. The bay-lagoon region was eroded to a maximum depth of 70 m during a low stand of the sea, possibly in Tertiary times. A combination of a powerful northerly littoral drift and a strong prevailing southeasterly wind has provided the region with plentiful supplies of sediments at least throughout the Quarternary. Extensive marine terracing during the last interglacial was almost certainly followed by further infilling during the Wurm glaciation by the unvegetated and easily transportable sands that were left behind by the retreating sea. The lagoon developed behind a northerly prograding spit during the subsequent recovery of the sea. (Steiner-Mass)
W80-00012

THE FLUVIAL SYSTEM: SELECTED OBSERVATIONS,
California Univ., Santa Barbara. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2E.
W80-00019

THE ROLE OF OVERWASH AND INLET DYNAMICS IN THE FORMATION OF SALT MARSHES ON NORTH CAROLINA BARRIER ISLANDS,
Massachusetts Univ., Amherst. Dept. of Botany.
For primary bibliographic entry see Field 2L.
W80-00035

DIAGENESIS OF ORGANIC MATTER IN THE SEDIMENTS OF LAKES ONTARIO, ERIE, AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2K.
W80-00088

NON-UNIFORM VERTICAL DISTRIBUTION OF FINE SEDIMENT IN THE AMAZON RIVER,
Geological Survey, Denver, CO.; and Edinburg Univ. (Scotland). Grant Inst. of Geology.
W. F. Curtis, R. H. Meade, C. F. Nordin, Jr., N. B. Price, and E. R. Sholkovitz.
Nature, Vol. 280, p 381-383, August 1979. 2 fig, 7 ref.

Descriptors: *Sediment transport, *Particle size, *Suspension, *Sampling, Methodology, South America, High flow, *Amazon River, Suspended sediment.

Curves show particle-size distribution of suspended sediment collected by different sampling methods in the Amazon River during high-water seasons of 1976 and 1977. Samples were collected between the mouth of the Amazon River and Iquitos, about 3,700 km upstream from the mouth. Sampling equipment included Niskin bottles, a point sampler, a depth-integrating sampler, and a bucket. Sediment concentrations of fine sediments from near-surface samples were about 50 percent of the concentrations from depth-integrated samples. (Woodard-USGS)
W80-00220

SEDIMENT YIELD EQUATION FROM AN EROSION SIMULATION MODEL,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Water Research Center.
E. D. Shirley, and L. J. Lane.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Az. p 90-96, 2 fig, 8 ref.

Descriptors: *Sedimentation rates, *Sediment yield, *Water pollution sources, *Estimating equation, *Equations, *Overland flow, *Simulation analysis, Model studies, Sedimentation, Erosion, Numerical analysis, Rill erosion, Runoff, Hydraulic properties, Watershed management, Land use, Forecasting.

It is important to assess the impact of various land use and management practices upon sediment yield, a significant water pollutant, from upland areas. Accordingly, a simplified sediment yield equation is derived here from partial differential equations for overland flow with rill and interrill erosion on a plane to facilitate the prediction of erosion and sediment yield as functions of runoff, soil and watershed characteristics. The equation which incorporates hydraulic resistance, rill and interrill erodibility terms, distance (watershed area) and runoff volume was used to compute sediment yields for a number of events on a small semiarid watershed. Computed sediment yields compared favorably with observations and with estimates made with the Universal Soil Loss Equation (USLE), although the derived sediment yield equation accounts for decreasing sediment yield with increasing watershed area. It is concluded, based upon this analysis of the sediment yield equation and its properties that it produces reasonable estimates for sediment yields in small semiarid watersheds. (Tickes-Arizona)
W80-00280

GEOMORPHIC FEATURES AFFECTING TRANSMISSION LOSS POTENTIAL ON SEMIARID WATERSHEDS,
Science and Education Administration, AZ. Southwest Watershed Research Center.
D. E. Wallace, and L. J. Lane.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Arizona, p 157-164, 8 fig, 9 ref.

Descriptors: *Geomorphology, *Water loss, *Ephemeral streams, *Stream erosion, Semiarid climates, Equations, Channel erosion, Gravels, Alluvium, Sediment load, Sediment yield, Stream gages, Data collections, Drainage area, Stream stabilization, Watersheds(Basins), Arizona.

An attempt is made to devise a workable method of estimating the volumes of channel fill or stream gravel in ephemeral drainage networks in southeastern Arizona based upon the concept that the analysis of stream order and drainage area versus alluvium volume allow preliminary estimates of transmission loss potential to be made for ungaged areas. Data collected at the Santa Rita Experimental Range 30 miles south of Tucson and at the Walnut Gulch Experimental Watershed near Tombstone, Arizona, indicated watershed area to be the dominant variable. As compared with the effect of the watershed area, stream order did not exert any great influence on the equations derived, although the credibility of using drainage area alone in the predictive equation has been enhanced by the analysis of relations existing between width and depth of ephemeral channels versus stream order and those existing between drainage network versus watershed area. It is concluded that the method elucidated is sufficiently accurate to use as a tool for estimating transmission loss potential in preliminary site evaluation and land resource surveys. (Tickes-Arizona)
W80-00289

ORGANOCHLORINE INSECTICIDES AND PCB IN SURFICIAL SEDIMENTS (1968) AND SEDIMENT CORES (1976) FROM LAKE ONTARIO,
Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.
For primary bibliographic entry see Field 5A.
W80-00341

INFLUENCE OF NEARSHORE TILL LITHOLOGY ON LATERAL VARIATIONS IN COASTLINE RECESSION RATE ALONG SOUTHEASTERN LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
D. H. Gray, and B. H. Wilkinson.
Journal of Great Lakes Research, Vol. 5, No. 1, p 78-83, 1979. 5 fig, 2 tab, 18 ref.

Descriptors: *Lake Michigan, *Shores, *Beach erosion, Lakes, Coasts, Petrology, Geology, Soils, Rocks, Till, Glacial drift, Waves(Water), Water levels, Geomorphology, Erosion rates, Erosion, Bluffs, Bluff recession rates.

Retreat of coastal bluffs around margins of the Great Lakes is a continuing process. Despite the positive correlation which exists between lake level and recession rates, considerable lateral variation in rates is typical of many coastal areas, while causes of this spatial variation are not well understood. Detailed examination of a 10 km segment of Lake Michigan shore near the town of Glenn, Michigan, suggested that lateral variations in the lithology of Pleistocene drift are directly correlative with spatial variations in recession rates. High recession rates and concave shorelines occur along segments composed of either outwash sand or sandy till which contains gravel up to 2 cm in diameter as the coarsest clast size. Conversely, low rates and the occurrence of convex shoreline segments are related to exposures of bouldery till. The exact nature of the relationship between bouldery till and the low recession rates is ambiguous. Features observed along this area suggest two nonmutually exclusive possibilities: (1) during erosion, bouldery till develops flat gently sloping wave-cut benches in the upper shoreface; and (2) erosion of this coarse till results in the development of upper shoreface surfaces covered with large boulders. Both features may serve to attenuate wave energy in the nearshore zone. In either case, lateral variation in the recession rates near Glenn is greatly influenced by the lithology of glacial drift exposed in bluff faces and the nearshore areas. (Sims-ISWS)
W80-00348

2K. Chemical Processes

RATE OF LOSS OF AMMONIA FROM WATER TO THE ATMOSPHERE,
Canada Centre for Inland Waters, Burlington (Ontario); and National Water Research Inst., Burlington (Ontario).
R. R. Weiler.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 6, p 685-689, June 1979. 3 fig, 1 tab, 13 ref.

Descriptors: *Ammonia, *Boundary processes, *Air-water interfaces, *Laboratory tests, Atmosphere, Water quality, Testing procedures, On-site investigations, Foreign research, Wind velocity, Hydrogen ion concentration, Analysis, Analytical techniques, *Exchange coefficients, Ammonia loss.

The rate of loss of ammonia from water to the atmosphere was measured both in the field and in the laboratory as a function of wind speed, temperature, and pH. The exchange coefficient, K sub e, was found to be a linear function of wind speed and temperature. Although the loss rates (1-10 kg/ha/d) are quite high at pH 9 and at ammonia concentrations greater than 1 mg N/cu dm, the rates are much smaller under the conditions found in most natural water bodies. (Humphreys-ISWS)
W80-00075

DIAGENESIS OF ORGANIC MATTER IN THE SEDIMENTS OF LAKES ONTARIO, ERIE, AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
A. L. W. Kemp, and L. M. Johnston.
Journal of Great Lakes Research, Vol. 5, No. 1, p 1-10, 1979. 3 fig, 5 tab, 21 ref.

Descriptors: *Great Lakes, *Sediments, *Organic matter, *Lake Ontario, *Lake Erie, *Lake Huron, Chemicals, Chemical reactions, Diagenesis, Amino acids, Carbohydrates, Lipids, Sampling, Cores, Chemical analysis, Lakes, Lake sediments, Bottom sediments, Sedimentation, Sedimentology, Limnology.

The organic matter in the modern sediments of Lakes Ontario, Erie, and Huron is composed of humic compounds (68 to 83%), amino acids (19 to 20%), lipids (2 to 8%), carbohydrates (2 to 6%), and amino sugars (0.5 to 4%). Amino acid and carbohydrate concentrations are high in plankton samples, which are the primary source of the sedimentary organic matter. These compounds are decomposed during their passage through the food chains and while resting at the sediment-water interface with the concurrent formation of humic compounds. The degree of diagenesis of the modern sedimentary organic matter is related to both the trophic state of the lake and to the water depth, with the greatest amount in the most eutrophic lake basins and in the shallowest water depths. Diagenesis of the organic matter is rapid prior to burial in the sediments and is slow after burial. The decomposition rates of the sedimentary organic matter are in the following order: amino acids much greater than amino sugars greater than carbohydrates greater than humic compounds greater than lipids. (Sims-ISWS)
W80-00088

TRICHLOROFLUOROMETHANE IN GROUNDWATER--A POSSIBLE TRACER AND INDICATOR OF GROUNDWATER AGE,
Indiana Univ. at Bloomington. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W80-00096

PRECIPITATION AND STREAMWATER CHEMISTRY IN AN UNDISTURBED FORESTED WATERSHED IN NEW HAMPSHIRE,
Northeastern Forest Experiment Station, Durham, NH.
C. W. Martin.
Ecology, Vol. 60, No. 1, p 36-42, Feb 1979. 4 fig, 4 tab, 24 ref.

Descriptors: *Cycling nutrients, *Forest watersheds, *Nitrogen, Chemistry of precipitation, Hydrology, Ion transport, Nutrients, Streamflow, Watershed(Basins), Biogeochemistry, *Forest hydrology, Chemistry of streams, Forest succession, New Hampshire, Undisturbed forest.

Precipitation and streamwater from the Bowl, a watershed in central New Hampshire, were analyzed chemically during 1973 and 1974. The Bowl, covered by northern hardwood forest with spruce and fir at higher elevations, has never been logged or disturbed by humans. The biogeochemistry of the cations seemed to be regulated more by precipitation, soil-water movement, and chemical weathering reactions than by forest succession. Nitrate concentrations remained nearly constant in the streamwater throughout the study, with no apparent seasonal fluctuations; in contrast, nitrate concentrations in the stream draining a nearby 55-

yr-old forest definitely declined during the growing season. Nitrate budgets indicated a net loss of this important plant nutrient from both watersheds. A net accumulation of ammonium was sufficient to give a net increase of total nitrogen in both watersheds. These data do not support the hypothesis of Vitousek and Reiners that old-growth forests may reach a point of no net growth and no net uptake of nutrients. Mixed deciduous-coniferous forests in New England, free from human disturbances, may reach an age where they become prone to natural disturbances that create a mossaic of similar-aged groups of trees, each group having differing abilities to accumulate nutrients. (Forest Service)
W80-00201

GROUND-WATER DATA IN THE BAKER COUNTY-NORTHERN MALHEUR COUNTY AREA, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-00226

GROUND-WATER RESOURCES OF WASHINGTON PARISH, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-00227

APPLICATION OF GEOCHEMICAL KINETIC DATA TO GROUND-WATER SYSTEMS: A TUFFACEOUS-ROCK SYSTEM IN SOUTHERN NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
H. C. Claassen, and A. F. White.
In: Chemical Modeling in Aqueous Systems: American Chemical Society Symposium Series, No. 93, p 771-793, September 1978. 8 fig, 4 tab, 11 ref.

Descriptors: *Aquifer characteristics, *Chemical properties, *Kinetics, *Sorption, *Water quality, Model studies, Diffusion, Geochemistry, Waste assimilative capacity, Montmorillonite, Nevada, *Rainier Mesa, Water quality simulation.

Kinetic modeling was used to estimate the effective surface area of aquifer in contact with a unit volume of ground water for a composite saturated-unsaturated ground-water system in southern Nevada. This aquifer property, not obtainable by other means, is necessary for realistic modeling of solute transport in ground-water systems. The results of the kinetic modeling indicate that only a small part of the total interconnected pore space is available for transport of water to the water table. The aquifer studied is composed of both vitric (glassy) and devitrified (crystalline) volcanic tuff of nearly identical chemical composition. Comparison of laboratory and field data indicated that only the vitric phase has a significant influence on ground-water composition. Laboratory determination of mass-transfer rates from the vitric material to solution as functions of pH allowed simulation of the natural water's cation composition. Simulated results were improved considerably when the model was modified to take into account precipitation of the clay mineral, montmorillonite. Estimates of surface area per unit volume obtained from the kinetic model are 0.3 to 3 percent of those obtained independently from Braunauer-Emmett-Teller surface area measurements. (Woodard-USGS)
W80-00232

PYRITE: ITS RAPID FORMATION IN A SALT MARSH AND ITS IMPORTANCE TO ECOSYSTEM METABOLISM,
Woods Hole Oceanographic Institution, MA. Joint Program in Biological Oceanography.
R. W. Howarth.
Science, Vol. 203, No. 4375, p 49-51, 5 January 1979. 2 tab, 14 ref.

Descriptors: *Pyrite, *Salt marshes, *Ecology, Sulfur, Sulfur compounds, Metabolism, Wetlands, Marshes, Respiration, Peats, Ecosystems.

Pyrite formation in salt-marsh peat occurs more rapidly than is generally thought for any natural system. Pyrite is the major end product of sulfate reduction, and sulfate reduction is the major form of respiration in the salt-marsh ecosystem. When the rapid formation of pyrite is ignored, the rates of sulfate reduction and ecosystem respiration may be grossly underestimated. (Stihler-Mass)
W80-00311

RESISTANCE OF THE MICROBIAL COMMUNITY WITHIN SALT MARSH SOILS TO SELECTED PERTURBATIONS,
Georgia Univ., Athens. Dept. of Microbiology.
For primary bibliographic entry see Field 2I.
W80-00314

NITROGEN DYNAMICS AND MODELING IN A FRESHWATER WETLAND,
Michigan Univ., Ann Arbor.
M. F. Bender.
Ph.D. Dissertation, 1976. 108 p.

Descriptors: *Freshwater marshes, *Nitrogen, *Model studies, Wetlands, Marshes, Bogs, Peat, Nitrogen cycle, Nitrates, Nitrites, Ammonia, Marsh plants, Mathematical models, Root zone, Distribution patterns.

The concentrations of the oxidized forms of nitrogen, nitrites and nitrates exhibit seasonal variations and variations caused by vegetative cover type. Nitrogen concentrations drop in late spring-early summer because of absorption by emergent vegetation. During the growing season, nitrite concentrations increase in the root zone and then decrease until late fall when near concentrations in the root zone and below the root zone are nearly the same. The magnitude of the difference in mean concentration for both nitrate-nitrite, and ammonium between the surface and the root zone varies with the vegetative cover type. Generally, leatherleaf-bog birch areas showed a greater difference than the other areas examined. Ammonium concentrations in the peatland-marsh are dependent upon the vegetative cover type, the season, and the depth. Two types of nitrogen models were derived: (1) a set of six empirical algebraic equations for predicting nitrate-nitrite, and ammonium concentrations for the three dominant vegetative cover types in the peatland-marsh, (2) a compartmental model with nitrogen in the five forms: nitrate, ammonium, nitrogen in living organic form, nitrogen in dead organic form, and nitrogen in gaseous forms expressed as time varying differential equations in the five primary components in the wetland. (Steiner-Mass)
W80-00327

2L. Estuaries

WATER RELATIONS OF THREE MANGROVE SPECIES IN SOUTH FLORIDA,
San Diego State Univ., CA. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-00009

COMPARATIVE ECOLOGICAL REQUIREMENTS OF A PERENNIAL AND AN ANNUAL SALICORNIA SPECIES: GERMINATION AND GROWTH DURING THE EARLY STAGES OF DEVELOPMENT, (IN FRENCH),
Centre National de la Recherche Scientifique, Montpellier (France). Centre d'Etudes Phytosociologiques et Ecologiques Louis-Emberger.
For primary bibliographic entry see Field 2I.
W80-00010

SURFICIAL SEDIMENTS OF SALDANHA BAY AND LANGEBAAN LAGOON,
Cape Town Univ. (South Africa). Dept. of Geology.
For primary bibliographic entry see Field 2J.
W80-00012

GROWTH AND SALT ACCUMULATION IN TWO ANNUAL SPECIES OF SALICORNIA FROM THE MEDITERRANEAN COAST, (IN FRENCH),
Centre National de la Recherche Scientifique, Montpellier (France). Dept. de Physiologie Ecologique.
For primary bibliographic entry see Field 2I.
W80-00018

THE INFLUENCE OF SALINITY, INUNDATION AND TEMPERATURE ON THE GERMINATION OF SOME HALOPHYTES AND NON-HALOPHYTES,
Vrije Univ., Amsterdam (Netherlands). Biological Lab.
For primary bibliographic entry see Field 2I.
W80-00022

BEACH AND SALT MARSH VEGETATION OF THE NORTH AMERICAN PACIFIC COAST,
California Univ., Santa Barbara. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2I.
W80-00031

A REVIEW OF STRUCTURE IN SEVERAL NORTH CAROLINA SALT MARSH PLANTS,
North Carolina State Univ. at Raleigh. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-00032

SALT TOLERANCE OF MANGROVES AND SUBMERGED AQUATIC PLANTS,
Texas Univ. at Austin. Plant Ecology Research Lab.
For primary bibliographic entry see Field 2I.
W80-00033

MATHEMATICAL MODELING--SPARTINA,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2I.
W80-00034

THE ROLE OF OVERWASH AND INLET DYNAMICS IN THE FORMATION OF SALT MARSHES ON NORTH CAROLINA BARRIER ISLANDS,
Massachusetts Univ., Amherst. Dept. of Botany.
P. J. Godfrey, and M. M. Godfrey.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.). Academic Press, Inc., New York, p 407-427, 1974. 12 fig, 11 ref.

Descriptors: *Salt marshes, *Geomorphology, *Overland flow, Wetlands, Marshes, North Carolina, Islands, Inlets(Waterways), Storm runoff, Soil dynamics, Land forming.

Analysis of time sequence aerial photographs and field studies at Codds Creek, Cedar Inlet, and Drum Inlet suggest that the present pattern of salt marshes behind the Outer Banks is the result of overwash deposition and inlet dynamics. Oceanic overwash provides sand from the beach during every severe storm, while inlet closure forms new marshes at much longer intervals. Once the inlet is closed, however, marsh formation proceeds rapidly. Both processes are of prime importance and complement each other; submergence of uplands by rising sea level also leads to new salt marshes, but this is a more important process on the mainland than on the Outer Banks. (Steiner-Mass)
W80-00035

PROBABLE AGENTS FOR THE FORMATION OF DETRITUS FROM THE HALOPHYTE, SPARTINA ALTERNIFLORA,
Brunswick Junior Coll., GA.
For primary bibliographic entry see Field 2I.
W80-00036

REMOTE SENSING AS A TOOL FOR STUDYING THE ECOLOGY OF HALOPHYTES,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 7B.

W80-00037

RELATIONSHIP OF VERTEBRATES TO SALT MARSH PLANTS,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2I.
W80-00038

NUTRIENT LIMITATION IN SALT MARSH VEGETATION,
Boston Univ. Marine Program, Woods Hole, MA. Marine Biological Lab.
For primary bibliographic entry see Field 2I.
W80-00039

THE POTENTIAL ECONOMIC USES OF HALOPHYTES,
Scrippts Institution of Oceanography, La Jolla, CA. Foundation for Ocean Research.
For primary bibliographic entry see Field 6C.
W80-00040

WINTER CIRCULATION IN THE WESTERN GULF OF MAINE: PART 2. CURRENT AND PRESSURE OBSERVATIONS,
Woods Hole Oceanographic Institution, MA.
J. A. Vermersch, R. C. Beardsley, and W. S. Brown.
Journal of Physical Oceanography, Vol. 9, No. 4, p 768-784, July 1979. 20 fig, 3 tab, 25 ref, 1 append. NSF DES74-03001, OCE76-01813.

Descriptors: *Ocean circulation, *Winter, *Coasts, *Maine, Continental shelf, Currents(Water), Ocean currents, Circulation, Water circulation, Winds, Pressure, Tides, Sampling, On-site investigations, Instrumentation, Equipment, Data processing, Oceanography, *Gulf of Maine.

The wintertime circulation in the western Gulf of Maine was studied with moored current, temperature, and pressure array, which was deployed from November 1974 to January 1975. These observations were interpreted with three additional data sets: coastal sea level records, Portland Lightship meteorological data, and offshore hydrographic transect data which describe the evolution of the density field on weekly time scales. The observed mean currents were consistent with the idea of a cyclonic Gulf of Maine gyre. The subtidal current fluctuations were coherent in the vertical at each mooring but were incoherent between the moorings, which were separated by about 50 km in both the alongshore and offshore direction. Furthermore, the currents showed only weak coherence with the winds. The pressure field was highly coherent over the whole Gulf of Maine. Therefore, estimates of the pressure gradient vector inside and outside the 100 m isobath were made using coastal subsurface and bottom pressure records. The alongshore pressure gradient for the deeper water was found to be quite coherent with the winds for periods between 35 and 200 h. The relation of the pressure gradients and the winds in the shallower water suggests the development of a transient coastal boundary layer. (See also W78-08579) (Sims-ISWS)
W80-00069

TRITIUM AND OXYGEN PROFILES IN THE EASTERN MEDITERRANEAN,
Laboratorio di Geologia Nucleare, Pisa (Italy).
For primary bibliographic entry see Field 5B.
W80-00078

ON THE GREEN'S FUNCTION OF LAPLACE'S TIDAL EQUATION, AN APPLICATION TO THE NORTHERN ADRIATIC SEA,
Rome Univ. (Italy). Ist. di Fisica.
E. Paschini, and E. Salusti.
Tellus, Vol. 31, No. 2, p 145-149, April 1979. 2 fig, 1 tab, 9 ref.

Descriptors: *Tides, *Water levels, *Mathematical models, Laplaces equation, Model studies, Analytical techniques, Theoretical analysis, On-site tests, Sea level, Equations, Analysis, Foreign research, *Adriatic Sea, *Venice(Italy), *Italy, Greens function.

To evaluate the effect of external forces on the northern water motion of Adriatic Sea, Green's Function of Laplace's tidal equation was calculated for a simple geometry. As an application, known data on sea level variations at various stations were used, in order to determine the external forces. The 'theoretical' sea level at Venice was computed. Its comparison with 'experimental' data taken at Venice gave encouraging results. The numerical results showed a remarkable agreement between theoretical and experimental data. (Humphreys-ISWS)
W80-00079

A DYNAMIC THERMODYNAMIC SEA ICE MODEL,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W80-00084

TEMPORAL RATES OF GROWTH AND DECAY OF MICROSCOPIC AND MACROSCOPIC SURFACE STRUCTURES IN A WIND-WAVE TANK,
Delaware Univ., Newark. Coll. of Marine Studies.
J. Wu.
Journal of Physical Oceanography, Vol. 9, No. 4, p 802-814, July 1979. 9 fig, 21 ref, 1 append. ONR N00014-75-C-0285.

Descriptors: *Waves(Water), *Growth rates, *Winds, *Laboratory tests, Friction, Fluid friction, Remote sensing, Radar, Data processing, Statistics, Oceanography, Wave decay.

The distributions of water surface slopes and wave heights were measured under suddenly started and stopped winds. The root-mean-square slopes and average wave heights were found to grow and decay exponentially with time; in each case, the growth rate was faster than the decay rate. Quantitative growth and decay rates of these slopes and heights approaching and departing an equilibrium state, respectively, were presented. The growth rates show strong dependence, and the decay rates show insignificant dependence on wind-friction velocity. The growth time of slope statistics was found to be shorter than that of height statistics, suggesting that the ripples can be excited directly and effectively by the wind and that wave-wave interaction and wind gusts are important to wave generation by wind. This comparison, along with measurements of instantaneous growth of microscopic surface structures reported by others, also revealed that the development of the wave spectrum indeed starts at the high-frequency end, and that for remote sensing of sea-surface wind an uncertainty is introduced by unsteadiness of the wind. (Sims-ISWS)
W80-00085

ROLE OF DYNAMIC COASTAL PROCESSES IN THE IMPACT AND DISPERSAL OF THE AMOCO CADIZ OIL SPILL (MARCH 1978) BRITTANY, FRANCE,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W80-00154

PLANTS AND ANIMALS OF THE ESTUARY.
Connecticut Arboretum Bull. No. 23, June, 1978. 44 p, 13 ref. Olmstead, N. C. (ed.), Connecticut College, New London.

Descriptors: *Estuaries, *Invertebrates, *Fish, *Algae, Connecticut, Animals, Aquatic plants, Coastal areas, Seashores, Wetlands.

This non-technical guide describes and illustrates the typical animals (invertebrates and fishes) and seaweeds of the shallow nearshore Connecticut waters. (See W80-00301 and W80-00302) (Stihler-Mass)
W80-00300

PLANT LIFE OF THE ESTUARY,
Connecticut Coll., New London.
S. L. Taylor, and M. Willalard-Bohusack.
In: Plants and Animals of the Estuary, Connecticut Arboretum Bull. No. 23, p 4-12, 1978.

Descriptors: *Estuaries, *Algae, *Coastal areas, *Connecticut, Aquatic plants, Phaeophyta, Chlorophyta, Rhodophyta, Wetlands.

Green, brown, and red algae typical of shallow nearshore Connecticut water are described and illustrated. Eelgrass is also discussed. (See also W80-00300) (Stihler-Mass)
W80-00301

ESTUARINE ANIMALS,
Connecticut Coll., New London.
N. C. Olmstead, and P. E. Fell.
In: Plants and Animals of the Estuary, Connecticut Arboretum Bull. No. 23, p 12-44, 1978.

Descriptors: *Estuaries, *Animals, *Invertebrates, *Fish, Connecticut, Coastal areas, Seashores, Wetlands.

This non-technical guide describes and illustrates the typical animals (sponges, cnidarians, comb jellies, segmented worms, molluscs, arthropods, bryozoans, echinoderms, and chordates) of shallow nearshore Connecticut waters. (See also W80-00300) (Stihler-Mass)
W80-00302

FISHERY SURVEY OF CEDAR LAKES AND THE BRAZOS AND SAN BERNARD RIVER ESTUARIES,
Texas Parks and Wildlife Dept., Austin.
For primary bibliographic entry see Field 2H.
W80-00305

MANGROVES: A REVIEW,
Environmental Research Lab., Gulf Breeze, FL; and Corvallis Environmental Research Lab., OR. Associate Lab.
For primary bibliographic entry see Field 2I.
W80-00319

MARSH SOILS OF THE ATLANTIC COAST,
Delaware Univ., Newark. Dept. of Plant Science.
For primary bibliographic entry see Field 2G.
W80-00320

THE RELATIONSHIP OF MARINE MACROINVERTEBRATES TO SALT MARSH PLANTS,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2I.
W80-00321

BUBBLE POPULATIONS AND SPECTRA IN COASTAL WATERS: A PHOTOGRAPHIC APPROACH,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
B. D. Johnson, and R. C. Cooke.
Journal of Geophysical Research, Vol. 84, No. C7, p 3761-3766, July 20, 1979. 10 fig, 14 ref.

Descriptors: *Bubbles, *Coasts, *Waves(Water), *Turbulence, Ocean waves, Winds, Photography, On-site investigations, Sampling, Measurement, Equipment, Instrumentation, Oceanography.

A photographic analysis of bubbles generated in coastal seas by breaking waves and general turbulence has allowed the number and spectrum of sizes of bubbles greater than 17 micrometers in radius to be counted and observed. A distribution of numbers and sizes was presented for bubbles at 1.5-m depth arising from wave activity driven by winds of from 8 to 10 m/s; under these conditions, the number of bubbles was 27,000/cu m. In winds of 11-13 m/s, the numbers of bubbles determined from photographs were 480,000/cu m at 0.7-m depth, 160,000/cu m at 1.8-m depth, and 16,000/cu m at 4-m depth. The data acquired by this tech-

nique enabled the authors and others to calculate the rate of the invasion of atmospheric gas into and out of the sea and to investigate the production of nonliving organic particulate matter by the processes of adsorption and bubble dissolution. The numbers of bubbles that do not dissolve completely but rise to the sea surface and burst were also calculable and are fundamental to quantifying the production of marine aerosols. A comparison of this technique with classical acoustic methods is now imperative. (Sims-ISWS)
W80-00352

DENITRIFICATION IN A SALT MARSH ECOSYSTEM,
Marine Biological Lab., Woods Hole, MA. Boston Univ. Marine Program.
W. Kaplan, I. Valiela, and J. M. Teal.
Limnology and Oceanography, Vol. 24, No. 4, p 726-734, July 1979. 5 fig, 1 tab, 30 ref. NSF GA-41506, GA-43008, GA-43009.

Descriptors: *Denitrification, *Salt marshes, *Massachusetts, Nitrates, Nitrites, Nitrogen compounds, Nutrients, Wetlands, Marshes, Coastal marshes, Tidal marshes, Marsh plants, Vegetation, Temperature, Nitrification, Nitrogen fixing, Nitrogen cycle, Aquatic bacteria, Groundwater, Sampling, On-site investigations, *Great Sippewissett Marsh(MA).

The rate of denitrification measured throughout the year in various habitats of a New England salt marsh was correlated to temperature and was highest in the wettest habitats. Over 60% of the denitrification took place in the muddy creek bottoms. Annual denitrification exceeds nitrogen fixation. An amount of nitrate similar to the quantity consumed by denitrifiers is supplied by the flow of groundwater into the marsh and by nitrifiers within the marsh itself. (Sims-ISWS)
W80-00355

LAGRANGIAN AND EULERIAN MEASUREMENTS OF HORIZONTAL MIXING IN THE BALTIC,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
For primary bibliographic entry see Field 5B.
W80-00359

FRESHWATER AND THE FLORIDA COAST: SOUTHWEST FLORIDA.
For primary bibliographic entry see Field 6E.
W80-00367

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

WATER CONSERVATION AND ALTERNATIVE WATER SUPPLIES, PROCEEDINGS OF A SOUTHEAST REGIONAL CONFERENCE NOVEMBER 8-9, 1978 AT THE GEORGIA INSTITUTE OF TECHNOLOGY.
For primary bibliographic entry see Field 6D.
W80-00001

MODELING MANAGEMENT OF PONDEROSA PINE FOREST RESOURCES,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, AZ.
For primary bibliographic entry see Field 2A.
W80-00228

ACTION PROGRAMS FOR WATER YIELD IMPROVEMENT ON ARIZONA'S WATERSHEDS: POLITICAL CONSTRAINTS TO IMPLEMENTATION,
Arizona Univ., Tucson. School of Renewable Natural Resources; and Wisconsin Univ.-Madison. Dept. of Forestry.
H. J. Cortner, and M. P. Berry.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Az., p 45-52, 8 ref.

Descriptors: *Project post-evaluation, *Water yield improvement, *Administrative agencies, *Political constraints, *Watershed management, Surface waters, Comprehensive planning, Economic efficiency, Decision making, Project planning, Arizona Water Resources Committee, Arizona Watershed Program, Evaluation, Vegetation effects.

Although the Arizona Watershed Program's (AWP) research efforts have had considerable success over the past 22 years in its objective to further knowledge of the feasibility of vegetative manipulation and modification as a method of increasing surface water yields, its principal sponsor and supporter, the Arizona Water Resources (AWRC), has not, to date, met with similar success. Described are three of the AWRC's unsuccessful attempts to implement on-going action programs of vegetative management for water yield improvement: The Barr Report, the Ffolliott-Thorud Report, and the Globe Chaparral controversy, to illustrate how overstated program goals, unrealistic assumptions about the political feasibility of treatment types, extent, and intensity; failure to recognize the emergence of significant new decision-making participants, and unsettled questions concerning program costs and beneficiaries have contributed to setbacks in these programs. It is suggested that political as well as scientific constraints have accounted for reported failures in the implementation of the AWP action program objectives. (Tickes-Arizona)
W80-00275

RAINFALL-RUNOFF RELATIONSHIPS FOR A MOUNTAIN WATERSHED IN SOUTHERN ARIZONA,
Arizona Water Resources Research Center, Tucson.
M. Myhrman, C. B. Cluff, and F. Putman.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Arizona, p 165-170, 1 fig, 1 tab, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Water resources development, *Alternative planning, *Surface runoff, *Damsites, *Water harvesting, Storage, Water demand, Water supply, Runoff, Water conservation, Water yield improvement, Drainage area, Reservoir storage, Computer models, Arizona.

Based upon the need for additional water to meet the projected growth and demand of the Smithsonian Institution's Mt. Hopkins Astrophysical observatory in the Santa Rita Mountains, the present study was initiated to identify alternative water supply sources in this area. The study initially focused on Cottonwood Canyon due to its proximity to the Observatory's facilities, historical record of significant surface flow, and the presence of several practical dam sites; and a second alternative of a paved water harvesting catchment on a flat area near the summit of Mt. Hopkins. As the study progressed the focus gradually shifted from Cottonwood Canyon to a smaller unnamed drainage immediately to the south due to the presence in this drainage of a ready-made storage reservoir created by the replacement of fill during the road building process. In light of these excellent reservoir sites and the ease with which the road system within this drainage could be developed as a water harvesting system, the options being considered for Cottonwood Canyon and a paved catchment near the summit were abandoned and it was recommended that the two storage reservoirs be constructed with the upper reservoir serving for both water storage and for trapping the inevitable sediment load. A computer model was used to simulate the operation of the proposed system over a 12 year period. (Tickes-Arizona)
W80-00290

3C. Use Of Water Of Impaired Quality

WASTEWATER EFFLUENT-AN ELEMENT OF TOTAL WATER RESOURCE PLANNING,
Boyle Engineering Corp., Phoenix, AZ.
J. D. Goff.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Arizona, p 115-119.

Descriptors: *Effluents, *Planning, *Water reuse, *Alternative planning, Water demand, Wildlife management, Groundwater recharge, Recreation, Water supply, Industrial water, Cooling water, Comprehensive planning, Irrigation, Phoenix, Arizona, Powerplants.

Wastewater effluent utilization, a potentially major factor in solving the water supply needs for metropolitan Phoenix, is analyzed in terms of the various reuse options presently being studied including agricultural irrigation, fish and wildlife enhancement, groundwater recharge, industrial processing and cooling water, recreation, cooling water for power generation stations, and exchanging effluent for additional water supplies. It is concluded that if controlled reuse is to be planned in the interest of increasing the future public water supply, close cooperation is needed among all who will participate. (Tickes-Arizona)
W80-00284

3D. Conservation In Domestic and Municipal Use

SALVAGING WASTED WATERS FOR DESERT-HOUSEHOLD GARDENING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
D. H. Fink, and W. L. Ehrler.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Az., p 125-131, 5 tab, 3 fig, 6 ref.

Descriptors: *Wastewater disposal, *Water reuse, *Reclaimed water, *Water conservation, *Rainfall-runoff relationships, *Water harvesting, *Surface runoff, *Surface water availability, Water supply development, Water management(Applied), Water yield improvement, Runoff, Arid climates, Surface sealing, Irrigation techniques.

With the objective of determining if sufficient water would be salvaged by a typical desert, urban-household from normally wasted sources associated with the lot and household to adequately irrigate a garden and orchard, a 2000 sq ft house on a typical one fifth acre lot in three cities having climates similar to Phoenix, Tucson, or Prescott, Arizona was hypothesized and the amount of water available for yard watering calculated, provided that (1) only rainfall was available, (2) rainfall-runoff from covered areas associated with or adjacent to the lot was salvaged (roof, street, alley etc.), (3) gray-water from the household was utilized, (4) a portion of the lot was waterproofed to concentrate the runoff on the untreated portion, and (5) various combinations of the above were utilized to increase the amount of available water. It is demonstrated that these sources could be used singly or in combination to obtain the required amount of water with the actual amount available depending upon the precipitation, runoff and runon areas, runoff efficiency of the contributing area, and the number of people in the household. A number of horticultural plants are suggested that should best fit such an irregular irrigation scheme. (Tickes-Arizona)
W80-00285

3E. Conservation In Industry

PROCEEDINGS OF THE 8TH NATIONAL SYMPOSIUM ON FOOD PROCESSING WASTES, MARCH 30-APRIL 1, 1977, SEATTLE, WASHINGTON.
For primary bibliographic entry see Field 5D.
W80-00116

EFFLUENT POLISHING AND WASTEWATER REUSE AT SNOKIST GROWERS CANNERY,
Esvelt Environmental Engineering, Spokane, WA.
For primary bibliographic entry see Field 5D.
W80-00118

TOMATO CLEANING, WATER RECYCLE AND MUD DEWATERING,
National Canners Association, Berkeley, CA.
For primary bibliographic entry see Field 5D.
W80-00120

EFFLUENT GENERATION, ENERGY USE AND COST OF BLANCHING,
Science and Education Administration, Albany, CA. Western Regional Research Center.
For primary bibliographic entry see Field 5D.
W80-00122

WASTE REDUCTION BY PROCESS MODIFICATION IN SWEET CORN PROCESSING,
Science and Education Administration, Albany, CA. Western Regional Research Center.
G. H. Robertson, M. E. Lazar, J. M. Krochta, and D. F. Farkas.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 137-146, 1977. 5 tab, 5 ref.

Descriptors: *Food processing industry, *Industrial wastes, *Effluent streams, *Operations, *Sweet corn, Water conservation, Industrial water, Water consumption(Except consumptive use).

Effluent and yield comparisons were made for intact kernels and cut kernels of sweet corn, and experimental processing methods were evaluated relative to their potential for a full-scale operation. Normal-depth cut kernels, deeply cut kernels, hole-sawed and screened kernels, and pressed kernels were produced and washed in a shaker washer. The kernels were blanched and air cooled. Wash water and blanching water were collected, measured, and measurements were recorded. Intact kernel mixtures provided for substantial effluent reductions over the conventionally cut kernel mixtures. Intact kernels produced by pressing had substantially greater yields and provided for the highest yield with the lowest effluent of the four experimental methods. (See also W80-00116) (Small-FRC)
W80-00125

AN EFFECTIVE WASTEWATER MANAGEMENT PROGRAM FOR A FOOD PROCESSOR,
Eutek, Inc., Sacramento, CA.
For primary bibliographic entry see Field 5D.
W80-00130

REDUCTION OF WASTES FROM CUCUMBER PICKLE PROCESSING BY USE OF THE CONTROLLED CULTURE FERMENTATION PROCESS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5D.
W80-00139

WATER REUSE OF WASTEWATER FROM A POULTRY PROCESSING PLANT,
Pittsburgh Univ., PA.
For primary bibliographic entry see Field 5D.
W80-00142

WATER REUSE IN POULTRY PROCESSING: CASE STUDY IN EGYPT,
Alexandria Univ. (Egypt). Higher Inst. of Public Health.
For primary bibliographic entry see Field 5D.
W80-00143

3F. Conservation In Agriculture

TRICKLE IRRIGATION: PREVENTION OF CLOGGING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 5F.
W80-00074

RISING ENERGY PRICES, WATER DEMAND BY PERIURBAN AGRICULTURE, AND IMPLICATIONS FOR URBAN WATER SUPPLY: THE TUCSON CASE,
Science and Education Administration, Phoenix, AZ. Natural Resources Economics Div.
H. W. Ayer, and D. W. Gapp
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science Vol. 8, April 14-15, 1978, Flagstaff, Az. p 194-201, 6 tab, 17 ref.

Descriptors: *Costs, *Cost-benefit analysis, *Economic prediction, *Economic justification, *Water supply, Hydrologic budget, Urban hydrology, Water rates, Groundwater budget, Political constraints, Linear programming, Irrigation water, Municipal water, Competing uses, Legal aspects, Tucson, Arizona, Associated costs, Electric power costs.

The city of Tucson, Arizona, the largest city in the U.S. to meet its water needs entirely from diminishing underground sources, is presently experiencing increasing water rates and the political turmoil associated with those increases. With focus upon this increasingly serious problem, production function analysis and static linear programming are used here to estimate the impact of rising energy prices on farm profits, cropping patterns and irrigation water used in the Avra Valley, a periurban irrigated region adjacent to Tucson, in an effort to evaluate the impact of this community upon Tucson's municipal water demand. It is concluded that as energy prices increase and land is removed from agricultural production within the Avra Valley, Tucson's economic position will be bolstered in at least three ways: (1) there will be more water available, (2) the price which the city must pay for farmland in order to gain control of the underlying water should be diminished and the quantity of farmland for sale increased, and (3) with fewer people involved in irrigated agriculture, legal conflicts between competing users will be diminished. (Tickes-Arizona)
W80-00295

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

PROCEEDINGS, URBAN STORMWATER MANAGEMENT SEMINARS, ATLANTA, GEORGIA, NOVEMBER 4-6, 1975 AND DENVER, COLORADO, DECEMBER 2-4, 1975.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 889, Price codes: A22 in paper copy, A01 in microfiche. Environmental Protection Agency Washington D.C., WPD 03-76-01, 1976. 509 p.

Descriptors: *Storm runoff, *Project planning, *Watershed management, *Pollutant identification, *Legal aspects, Urban runoff, Storm water, Local governments, Water pollution control, Financing, Detention reservoirs, Waste water treatment, Waste water disposal, Municipal wastes.

Papers presented at the Urban Stormwater Management Seminars discussed the characterization of the urban stormwater problem, approaches to the urban stormwater problem, and institutional and legal aspects of urban stormwater management. A total of 23 papers are included with question and response sessions following many. The seminars were conducted to provide an overview of the urban stormwater problem and to assist agencies in the implementation of 208 planning in various regions. (See W80-00044 thru W80-00068) (Lisk-FRC)
W80-00043

BEST MANAGEMENT PRACTICES,
Environmental Protection Agency, Washington, DC. Water Planning Div.
D. Athayde.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975. p I-2-6, 1976.

Descriptors: *Urban runoff, *Storm water, *Water pollution sources, *Storage, Organic matter, Heavy metals, Microorganisms, Nutrients.

The best management practices for the prevention of urban runoff are discussed. Polluted urban runoff contains organic material, inorganic material, nutrients, heavy metals, and microorganisms Preventive methods can reduce stormwater pollution before runoff accumulates and enters the sewer system or through management and alteration of the collection system. The preventive approach focuses on developing areas and attempts to preserve the watershed's existing runoff characteristics. The preventive approach is less costly than storage and treatment of collected stormwater runoff. (See also W80-00043) (Small-FRC)
W80-00044

CONSIDERATIONS IN CHARACTERIZATION OF URBAN RUNOFF FOR PL 92-500 SECTION 208 PLANNING,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
F. J. Condon.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p I-9-32, 1976. 2 fig, 13 ref.

Descriptors: *Urban runoff, *Publications, *Mathematical models, *Project planning, Storm water, Sampling, Analytical techniques, Water pollution sources, Federal Water Pollution Control Act.

An overview is presented on characterizations of urban runoff applicable to Section 208 planning from several Environmental Protection Agency reports. The importance of data to the planner as opposed to mathematical modeling results is discussed. Considerations when planning data collection are presented including types of measurements, sampling conditions, and necessary synchronous data. Recommended procedures are outlined for storm-generated discharge projects. Analytical techniques and useful characteristics to be determined are discussed, and eighteen models are mentioned. (See also W80-00043) (Small-FRC)
W80-00045

INSTREAM IMPACTS OF URBAN RUNOFF,
E. D. Driscoll.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p I-54-76, 1976. 6 fig.

Descriptors: *Urban runoff, *Storm water, *Project planning, Water pollution sources, Water pollution control, Sampling, Analytical techniques.

Instream impacts of urban stormwater runoff are discussed in general and planning for pollution control is considered. Planning must identify the

problem in the receiving water by determining pollutant loads and receiving water characteristics. A study approach should include data collection and analytical procedures. (See also W80-00043) (Small-FRC)
W80-00046

LAND USE AND URBAN DEVELOPMENT AFFECTING STORMWATER POLLUTION AND WATER QUALITY,
Poertner (Herbert G.), Bolingbrook, IL.
H. G. Poertner.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p I-38-53, 1976. 3 fig, 1 tab, 13 ref.

Descriptors: *Urban runoff, *Storm water, *Precipitation(Atmospheric), Water pollution sources, Biochemical oxygen demand, Suspended solids, Waste water treatment, Land use, Microorganisms.

Assessment of pollution in stormwater runoff as a function of land use and urban development is discussed. Most stormwater runoff quality information is given as mean pollutant concentration or averages of samples taken from one or more runoff events. The relationships between rainfall, runoff, and time variations of other parameters are important but are not considered. Average-type data have characterized urban stormwater runoff as having a solids concentration equal to or greater than raw sewage, BOD concentrations equal to that of effluents from secondary treatment, and bacterial contamination 2 to 4 times less than that of untreated sewage. (See also W80-00043) (Small-FRC)
W80-00047

IMPACT OF CSO/SSD ON WATER QUALITY,
Metcalf and Eddy, Inc., Palo Alto, CA.
J. A. Lager.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975 and Denver, Colorado, December 2-4, 1975, p I-83-96, 1976. 5 fig, 7 ref.

Descriptors: *Combined sewers, *Urban runoff, *Mathematical models, *Monitoring, Water pollution sources, Storm water, Storm runoff.

The impacts of combined sewer overflows and storm sewer discharges on receiving waters are discussed. Investigations have primarily been limited to the impacts of aesthetics, contamination, and point source loadings, while modeling studies and continuous monitoring at key locations should be used. Examples of urban runoff impacts are discussed for San Francisco, Minneapolis-St. Paul, and Greater Seattle. Modeling results are discussed for Washington, D.C., Chicago, Reno, and Rochester. (See also W80-00043) (Small-FRC)
W80-00048

NON-POINT SOURCE IMPACT AND URBAN HOLDING CAPACITY,
GKY and Associates, Alexandria, VA.
For primary bibliographic entry see Field 4C.
W80-00049

RUNOFF AND QUALITY,
For primary bibliographic entry see Field 4C.
W80-00050

APPLICATIONS OF STORMWATER MANAGEMENT MODELS,
Metcalf and Eddy, Inc., Palo Alto, CA.
J. A. Lager.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p I-157-178, 1976. 4 fig, 3 tab, 4 ref.

Descriptors: *Storm water, *Mathematical models, *Project planning, Water quality, Costs, Storm runoff, Sampling.

The application of stormwater management models is discussed from the viewpoint of model selection. The selection procedure includes the definition of study objectives which means determining what improvement in water quality is needed, how much, and where. The required sensitivity of results and the assessment of existing data are discussed. Data are provided on comparisons of urban runoff models. A comprehensive program included verification of sampling costs at about $200,000 to $500,000. The most cost-effective utilization of modeling combines simplified and dynamic models in a single program. (See also W80-00043) (Small-FRC)
W80-00051

LAND MANAGEMENT TECHNIQUES FOR STORMWATER CONTROL IN DEVELOPED URBAN AREAS,
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 4C.
W80-00052

COST EFFECTIVE APPROACH FOR COMBINED STORM AND SEWER CLEAN-UP,
Energy and Environmental Analysis, Inc., Boston, MA.
W. C. Pisano.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p II-62-82, 1976. 4 fig, 3 tab.

Descriptors: *Urban runoff, *Sewerage, *Storm water, *Suspended solids, *Coliforms, Urban drainage, Watershed management, Water pollution sources, Mathematical models, Chlorination.

An overview is presented of a recent assessment of the cost-effectiveness of several alternative plans for reducing the frequency and magnitude of combined sewer overflows from two large, densely populated communities in Boston. Controls included wet and dry weather field sewer inspections, sewer flushing, off-line storage, and chlorination facilities. Beneficial and cost-effective remedial measures were yielded. A methodology was developed which predicted solids deposition in 0.5 million feet of collection systems covering 3000 acres. Daily predicted solids were reduced by 50% by daily flushing of 100 critical segments. The addition of off-line storage reduced pollutant loads. Marine coliform levels were monitored and in situ coliform death experiments were performed. The impacts of various fecal contamination control strategies were evaluated using the Boston Harbor water quality simulation model. (See also W80-00043) (Small-FRC)
W80-00055

COLLECTION SYSTEM CONTROL,
Metcalf and Eddy, Inc., Palo Alto, CA.
J. A. Lager.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p II-83-94, 1976. 3 fig, 8 ref.

Descriptors: *Urban runoff, *Storage, *Sewerage, *Waste water treatment, Storm water, Urban drainage, Costs, Pilot plants.

The basic concepts of collection system control are reviewed, problems in test applications are described, and the system's cost-effectiveness is evaluated. The system utilizes in-system storage and flow routing to optimize the collection and treatment of wet weather flows. Inflatable dams are used to increase storage under normal flow conditions. The Metropolitan Seattle system includes water quality monitoring and advanced control functions. It has 15 fully equipped regulation stations and one major pumping station. Maximum safe storage is equivalent to 0.05 inches of runoff. The system has reduced peak loadings by 80 to 90%. The system cost $5.3 million which includes computer controls and station control equipment. (See also W80-00043) (Small-FRC)
W80-00056

A COST-EFFECTIVE SWIRL COMBINED SEWER OVERFLOW REGULATOR/SOLIDS-SEPARATOR,
Municipal Environmental Research Lab., Cincinnati, OH.
R. I. Field.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p II-99-111, 1976. 13 fig, 1 tab, 9 ref.

Descriptors: *Treatment facilities, *Combined sewers, *Urban runoff, *On-site tests, Storm water, Costs, Suspended solids, Biochemical oxygen demand, Performance.

The dual functioning swirl unit is described which is the first regulator device of its type to offer the advantage of simultaneous control of the quality and quantity of combined sewer overflow. The facility is simple in design and economical to operate. It effectively reduces grit, settleable solids, BOD-5, and floatables. Performance is reviewed of a 3.5 m diameter swirl combined sewer overflow regulator in Syracuse, N. Y., which treats a 54-acre, single family residential area. Hydraulic model studies indicated that suspended solids removal efficiency of the swirl unit is 65%. Prototype total mass loading and concentration removal efficiency ranged from 44 to 65% and 18 to 55%, respectively. Capital costs were $55,000 with $2,000/year operation and maintenance costs. (See also W80-00043) (Small-FRC)
W80-00057

A REVIEW OF EPA'S URBAN RUNOFF POLLUTION CONTROL RESEARCH PROGRAM.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p II-112-117, 1976. 2 ref.

Descriptors: *Research programs, *Pilot plants, *Storm runoff, *Watershed management, *Sewerage, Urban runoff, Storm water, Water pollution sources, Water treatment, Mathematical models.

The Environmental Protection Agency's Storm and Combined Sewer Pollution Control Research Development and Demonstration Program is described. It includes more than 140 projects totaling about $100 million. The program is comprised of problem definition and development of effective control alternatives. Control methods include source control, sewerage system control, treatment, integrated systems, and computer models. (See also W80-00043) (Small-FRC)
W80-00058

URBAN STORMWATER DETENTION AND FLOW ATTENUATION FOR POLLUTION CONTROL,
Poertner (Herbert G.), Bolingbrook, IL.
H. G. Poertner.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p II-118-146, 1976. 5 fig, 6 ref.

Descriptors: *Storm water, *Storm runoff, *Storage, *Project planning, Water pollution sources, Waste water treatment, Legislation, Suspended solids, Urban runoff.

Properly operated stormwater detention facilities reduce or abate downstream water pollution and flooding. Detention reduces the pollution to receiving waters caused by suspended solids and sediments. Guidelines are presented for public agencies involved in designing, planning, or implementing stormwater management systems. First, the extent of pollution should be determined, a regional approach should be used to develop a master plan, and suitable legislation should be enacted. One of the most significant aspects is the selection of space for the temporary storage of runoff. (See also W80-00043) (Small-FRC)
W80-00059

URBAN STORMWATER MANAGEMENT PROBLEMS AND SOLUTIONS-OVERVIEW OF A NATIONWIDE STUDY,
Poertner (Herbert G.), Bolingbrook, IL.
H. G. Poertner.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p III-2-14, 1976.

Descriptors: *Project planning, *Storm runoff, *Urban runoff, *Watershed management, Water pollution sources, Storm water, Urban drainage.

Institutional urban and metropolitan stormwater management problems which delay or prevent effective and economical programs from being developed, are discussed. Solutions, proposed and real, are also reviewed. Data were collected through personal interviews in many areas and detailed case studies in Denver, Chicago, and the Washington D. C. suburbs of Virginia are presented. Most areas contacted lacked a master stormwater management plan, and financing was normally the greatest impediment or at least a major problem. Public education, especially education to accept financial responsibility, was generally lacking. (See also W80-00043) (Small-FRC)
W80-00060

THE INTERGOVERNMENTAL TANGLE FACING STORMWATER CONTROL,
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 4D.
W80-00061

STATE/LOCAL INTERACTION IN STORMWATER MANAGEMENT,
Virginia State Water Control Board, Richmond.
E. T. Jensen.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p III-45-56, 1976.

Descriptors: *Urban runoff, *Management, *Storm water, *Virginia, *Cost analysis, Project planning, Water pollution sources, Public benefits, Legislation, Waste water treatment, Municipal wastes.

Problems with stormwater management in Virginia are discussed. Mechanisms considered to increase public awareness of the need for stormwater management include severe flooding or drainage problems, water supply degradation, downstream water quality, and legislative declarations. Cost-effectiveness and public acceptance are considered severe constraints of alternative solutions to runoff problems. Major programs developed in 10 districts and counties of Virginia are cited. The roles of state, local, and federal governments in developing and managing stormwater programs are reviewed. (See also W80-00043) (Lisk-FRC)
W80-00062

LEGAL ASPECTS OF URBAN STORMWATER MANAGEMENT,
Shoemaker and Wham, Denver, CO.
W. J. Shoemaker.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p III-57-66, 1976. 2 ref.

Descriptors: *Urban runoff, *Storm water, *Legal aspects, *Storm runoff, *Real property, Overland flow, Governments, Watershed management, Municipal wastes.

The legal aspects of urban stormwater drainage and its management are discussed. Traditionally, owners of lower lying properties have been required to accept the stormwater runoff from upper properties. The lower property owner was required to accept no more water than would naturally flow onto the property. Stormwater runoff has had an impact on property values; property rights have a significant control on stormwater management, unless health and safety are affected. The relationship of stormwater management and various state, local, and federal agencies is reviewed. (See also W80-00043) (Lisk-FRC)
W80-00063

LEGAL ASPECTS OF URBAN STORM WATER MANAGEMENT AND RELATED POLLUTION ABATEMENT PROBLEMS,
F. E. Maloney.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p III-67-106, 1976. 115 ref.

Descriptors: *Storm runoff, *Legal aspects, *Urban runoff, *Storm drains, *Detention reservoirs, Legislation, Federal Water Pollution Control Act, Real property, Water pollution control, Watershed management, Municipal wastes.

The legal aspects of providing more and larger storm sewers, temporary stormwater detention in higher areas, and upgrading storm and combined sewers are reviewed. The problems of disposal of stormwater and the legal effects of the pollution problem are also discussed. Civil law rule, common enemy rule, and the doctrine of reasonable use are evaluated in terms of stormwater management approaches. The increased flow over lowlands, drainage into natural watercourses, and theories of action and legal remedies are also discussed. Problems with stormwater detention, the control of pollution in relation to stormwater management, common law development, and water pollution legislation are reviewed. The goals, enforcement and citizen suits, point and nonpoint sources, and navigable waters involved with the Federal Water Pollution Control Act are also discussed. (See also W80-00043) (Lisk-FRC)
W80-00064

FINANCING STORM WATER CONTROL PROJECTS,
J. Fountain, and D. Cochran.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p III-107-112, 1976.

Descriptors: *Financing, *Watershed management, *Storm runoff, *Costs, *Project planning, Cost-benefit analysis, Income, Taxes, Urban runoff, Municipal wastes.

Methods of financing stormwater improvements and an evaluation and design criteria are reviewed. Traditional methods of funding stormwater improvements considered include: current ad valorem property taxes, general obligation bonds issues, special assessments, private funds from developers, revenue sharing and community development act funds, and the use of water and sewer revenue bonds and renewal and extension funds. Criteria for evaluating the various funding techniques include the effects of the expenditures on other programs, identification of the beneficiaries of the program, and the program efficiency. The advantages and disadvantages of the programs are briefly reviewed. (See also W80-00043) (Lisk-FRC)
W80-00065

FINANCING STORMWATER PROJECTS,
Shoemaker and Wham, Denver, CO.
W. J. Shoemaker.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p III-113-121, 1976. 2 ref.

Descriptors: *Financing, *Watershed management, *Storm runoff, *Legal aspects, *Urban runoff, Project planning, Costs, Storm drains, Cost-benefit analysis, Waste water treatment, Municipal wastes.

A discussion of stormwater management program financing is presented. Financing of stormwater drainage projects may be assisted when public facilities, such as parks, and recreational and health facilities are incorporated. A definition of the term, benefit, for evaluation of drainage projects is considered necessary and an assessment is developed. Descriptions of existing programs are provided. (See also W80-00043) (Lisk-FRC)
W80-00066

PLANNING TO NARROW THE IMPLEMENTATION GAP,
Municipality of Metropolitan Seattle-METRO, WA
P. Wilson.
In: Proceedings of Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p III-122-131, 1976.

Descriptors: *Project planning, *Storm runoff, *Urban runoff, *Local governments, *Environmental effects, Analytical techniques, Watershed management, Planning, Municipal wastes.

Recommendations for reducing the gap between the planning and implementation of stormwater management programs are presented. The planning of programs should be as close to the implementation stages as possible, especially in areas of cost-effectiveness, institutional arrangements, and financial alternatives. The development of a framework of planning that incorporates operating agencies, regional planning agencies, and implementing agencies is urged; the identification of goals, objectives, policies, and the use of demographic data and projections based on timing and location of growth and development are recommended. Collaborative planning approaches assist in implementation. Critical analysis and evaluation of the planning should be conducted utilizing the environmental impact assessment process. Public participation in the planning effort is urged. (See also W80-00043) (Lisk-FRC)
W80-00067

IMPLEMENTATION OF URBAN STORMWATER RUNOFF PLANS,
Southeastern Wisconsin Regional Planning Commission, Waukesha.
G. C. Berteau.
In: Proceedings of Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p III-132-140, 1976.

Descriptors: *Project planning, *Storm water, *Urban runoff, *Watershed management, *Wisconsin, Storm runoff, Planning, Water pollution control, Legal aspects, Local governments, Waste water treatment, Municipal wastes.

Considerations and factors in the implementation of stormwater management projects are reviewed. Definitions are provided for conveyance facilities, effluent limitations, nonpoint sources, water pollution, water quality, urban area, and waste treatment planning agencies. A comprehensive stormwater management program should incorporate a total watershed or basin plan which considers natural resource protection, flood control, and water pollution abatement. Plans that have been developed and/or implemented in Wisconsin are reviewed. An agreed upon plan should have a schedule of implementing required capital improvements, should be prepared by a technically competent agency with areawide jurisdiction, should have the approval of the area's political, environmental, and economic leaders and the support of the public. (See also W80-00043) (Lisk-FRC)
W80-00068

SURFACE WATER DATA MANITOBA 1978.
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
1979, 169 p, in English and French.

Descriptors: *Data collections, *Stream gages, *Gaging stations, *Flow rates, *Water levels, *Flow measurement, Natural flow, Surface waters, Ice, Discharge measurement, Discharge(Water), Hydrologic data, Drainage area, *Manitoba.

The Water Resources Branch of the Department of the Environment presents for the 1978 calendar

year, the results of the hydrometric survey investigations which were made in Manitoba by the Water Survey of Canada. Tables containing information on daily water levels of discharge, summaries of monthly and annual data, and descriptive information are presented for each gauging station. Descriptive information includes type of gauge, location and drainage area. (WATDOC)
W80-00195

SURFACE WATER DATA YUKON AND NORTHWEST TERRITORIES 1978.
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
1979, 82 p, in English and French.

Descriptors: *Data collections, *Stream gages, *Gaging stations, *Flow rates, *Water levels, Flow measurement, Natural flow, Surface waters, Ice, Discharge measurement, Discharge(Water), Hydrologic data, Drainage area, *Yukon Territory, *Northwest Territories.

The Water Resources Branch of the Department of the Environment presents for the 1978 Calendar year, the results of the hydrometric survey investigations which were made in the Yukon and Northwest Territories by the Water Survey of Canada. Tables containing information on daily water levels of discharge, summaries on monthly and annual data, and descriptive information are presented for each gauging station. Descriptive information includes type of gauge, location and drainage area. (WATDOC)
W80-00196

EFFECTIVENESS OF SEALING SOUTHEASTERN ARIZONA STOCK PONDS WITH SODA ASH,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
H. B. Osborn, J. R. Simanton, and R. B. Koehler.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Az. p 73-78, 3 tab, 5 fig, 2 ref.

Descriptors: *Ponds, *Seepage control, *Soil sealants, Sodium carbonate, Stock water, Clays, Porosity, Soil chemistry, Soil treatment, Arizona.

Pond seepage losses are a particularly serious problem in the semiarid southwest where runoff-carried calcium normally causes well-dispersed clay particles to aggregate and increase the porosity of stock pond sediments. Reported are the results of laboratory and field tests carried out by the USDA Water Conservation Laboratory in Phoenix, Arizona to determine the success of sodium carbonate (soda ash) as a soil sealant and to establish criteria for its use. Following tests two leaky ponds on Walnut Gulch, Arizona were treated with soda ash broadcast over the dry pond surfaces to the spillway elevation at a rate of 3365 Kg/ha and mixed with the pond sediment to a depth of 10 cm with a disc. Seepage losses were compared following the summer rainy season, and generally represent 20 day periods in September or October when the summer monsoon rains have ended. The late season seepage loss for the after treatment period each year from 1968 through 1974 was reduced about 50% and the treatment on one pond seems to have lasted much longer than anticipated, thus increasing the value of the treatment. A pretreatment laboratory seepage test is suggested to better determine the likelihood of treatment success. (Tickes-Arizona)
W80-00278

4B. Groundwater Management

MONITORING OF SUBSURFACE INJECTION OF WASTES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-00222

USE OF DIGITAL MODELS TO MANAGE GROUND WATER,
Fox (F.M.) and Associates, Inc., Spokane, WA.
For primary bibliographic entry see Field 2F.
W80-00252

HYDROLOGIC FACTORS AFFECTING GROUNDWATER MANAGEMENT FOR THE CITY OF TUCSON, ARIZONA,
Arizona State Water and Sewer Dept., Tucson.
R. B. Johnson.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, April 14-15, 1978, Flagstaff, AZ, Vol. 8, p 1-8, 6 fig, 3 ref.

Descriptors: *Hydrologic properties, *Water supply, *Water wells, *Groundwater availability, *Water budget, *Urban hydrology, Water utilization, Groundwater mining, Water allocation, Water table, Hydrologic aspects, Comprehensive planning, Pumping, Costs, Subsidence, Water quality, Areal hydrogeology, Tucson, Arizona.

Both the positive and negative aspects of Tucson, Arizona's total dependence upon groundwater are examined in this assessment of the basic hydrologic and geologic parameters which presently control the occurance and availability of the city's water resources. Each of the several relevant parameters for Tucson's Interior, Southside, Santa Cruz, and Avra Valley well fields are evaluated, both individually and in combination, in an effort to supply the basis for a future comprehensive water plan. The relationship between documented water level declines and observed decreases in the production capacity of these major well fields are established and the additional effects of pumping costs, subsidence, and water quality considered in formulating management alternatives. It is concluded that while the present production levels of the Interior field should be reduced, increased withdrawals from the Avra Valley represents the best alternative course of action at the present time. (Tickes-Arizona)
W80-00269

OPTIMIZATION OF A DAM SYSTEM FOR RECHARGING RUNOFF WATER INTO THE GROUND,
Tahal Consulting Engineers Ltd., Haifa (Israel).
A. Nov, and P. Golany.
Water Resources Research, Vol. 15, No. 4, p 891-898, August 1979. 2 fig.

Descriptors: *Dams, *Recharge, Runoff, *Optimization, *Dynamic programming, *Cost minimization, Wells, Reservoirs, Groundwater, Hydrologic aspects, Annual yield, Flood routing, Equations, Mathematical models, Systems analysis, Mountainous catchments.

Presented is a method for a routine determination of an optimal combination of small dams in mountainous catchments. The method is meant for arid and semiarid climates, where wells are the main source of water. The objective of the dams is to impound runoff water and recharge it, through the reservoirs formed by them, into the ground, thereby augmenting the natural replenishment of groundwater. The objective function calls for a minimization of the cost of the recharged water. The optimization technique is dynamic programming. The method is confined to the mathematical formulation of the optimization procedure. Although this formulation is made in terms of the hydrological and geometrical variables concerned, no reference is made to the hydrological and structural information; it is assumed that this information is available. A purposful use of this optimization method requires appropriate methods (yet to be proposed) of supplying and processing the vast hydrological information necessary. The results obtained from application of the method (the cost of recharged water and a description of the corresponding dam system) are given for different, arbitrarily selected average annual recharge volumes up to the total average annual runoff yield of the catchment. From a rigorous formal point of view, the method violates the principles of dynamic programming. This violation becomes permissible owing to certain controls inherent in the process, regulating it from within. (Bell-Graf--Cornell)
W80-00362

CONTROLS AND REMEDIES FOR GROUND WATER - CAUSED LAND SUBSIDENCE,
For primary bibliographic entry see Field 6E.
W80-00389

4C. Effects On Water Of Man's Non-Water Activities

STREAM CHANNEL MODIFICATION IN HAWAII. PART A: STATEWIDE INVENTORY OF STREAMS: HABITAT FACTORS AND ASSOCIATED BIOTA,
Hawaii Cooperative Fishery Research Unit, Honolulu.
For primary bibliographic entry see Field 6G.
W80-00003

STREAM CHANNEL MODIFICATION IN HAWAII. PART B: EFFECT OF CHANNELIZATION ON THE DISTRIBUTION AND ABUNDANCE OF FAUNA IN SELECTED STREAMS,
Hawaii Cooperative Fishery Research Unit, Honolulu.
For primary bibliographic entry see Field 6G.
W80-00004

BEST MANAGEMENT PRACTICES,
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 4A.
W80-00044

CONSIDERATIONS IN CHARACTERIZATION OF URBAN RUNOFF FOR PL 92-500 SECTION 208 PLANNING,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
For primary bibliographic entry see Field 4A.
W80-00045

LAND USE AND URBAN DEVELOPMENT AFFECTING STORMWATER POLLUTION AND WATER QUALITY,
Poertner (Herbert G.), Bolingbrook, IL.
For primary bibliographic entry see Field 4A.
W80-00047

IMPACT OF CSO/SSD ON WATER QUALITY,
Metcalf and Eddy, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 4A.
W80-00048

NON-POINT SOURCE IMPACT AND URBAN HOLDING CAPACITY,
GKY and Associates, Alexandria, VA.
G. K. Young.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p I-98-115, 1976.

Descriptors: *Mathematical models, *Urban runoff, *Storm water, Storage, Water pollution sources, Urban drainage, Combined sewers.

A simplified average water quality model is presented which encompasses waste generation and receiving water quality. The impacts of control options that are implied by the model are considered, and the effects of density in the urban area are discussed. The model is applied to a typical Florida situation and holding capacity constraints are developed. Decreasing non-point load through better housekeeping or improved grading practices

and improved planning through increased density are two ways to enhance water quality. The pollutograph control model which focuses on an individual storm event is also described. Increasing storage capacity, and thus increasing the amount of reducing load of receiving waters, is effective. An increase of 10% in combined sewers decreases the load 1.3%. (See also W80-00043) (Small-FRC)
W80-00049

RUNOFF AND QUALITY,
E. D. Driscoll.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p I-122-144, 1976. 9 fig.

Descriptors: *Project planning, *Water quality, *Urban runoff, *Storm water, Precipitation(Atmospheric), Urban drainage, Storm runoff, Monitoring.

Programs for the local determination of runoff and water quality are considered. Variability in data occurs so a program must be selected to determine the relationship between local causes and variations. Careful spacing of rain gauges can reduce variations except for those related to storm or surface effects. A level of detail must be adopted that is consistent with the sensitivity of other elements in the analysis to the level of detail of the inputs. The study should concentrate on several small areas, flow measurement, and sampling stations should be located at a common point, and data should be collected on as many storm events as possible. The analysis should concentrate on the contaminants which have the most influence on receiving water. (See also W80-00043) (Small-FRC)
W80-00050

LAND MANAGEMENT TECHNIQUES FOR STORMWATER CONTROL IN DEVELOPED URBAN AREAS,
Environmental Protection Agency, Washington, DC. Water Planning Div.
K. Adgate.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p II-2-34, 1976. 12 tab, 17 ref.

Descriptors: *Storm water, *Urban runoff, *Social aspects, *Costs, Litter, Water pollution sources, Cleaning.

Alternative approaches to complete treatment of stormwater which are applicable to developed urban areas are discussed. Housekeeping techniques for abatement and control are discussed including street sweeping, improved trash collection, catch basin cleaning, sewer flushing, deicing material controls, and disconnection of roof leaders. These techniques are compared on socio- and cost-effective bases to aid in the selection of cost-effective control alternatives that are acceptable to the public. (See also W80-00043) (Small-FRC)
W80-00052

COST EFFECTIVE APPROACH FOR COMBINED STORM AND SEWER CLEAN-UP,
Energy and Environmental Analysis, Inc., Boston, MA.
For primary bibliographic entry see Field 4A.
W80-00055

COLLECTION SYSTEM CONTROL,
Metcalf and Eddy, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 4A.
W80-00056

URBAN STORMWATER MANAGEMENT PROBLEMS AND SOLUTIONS-OVERVIEW OF A NATIONWIDE STUDY,
Poertner (Herbert G.), Bolingbrook, IL.
For primary bibliographic entry see Field 4A.
W80-00060

EFFECTS OF MALATHION ON MICROORGANISMS OF AN ARTIFICIAL SALT-MARSH ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 2I.
W80-00303

BIOGEOCHEMISTRY OF A FORESTED ECOSYSTEM,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
G. E. Likens, F. H. Bormann, R. S. Pierce, J. S. Eaton, and N. M. Johnson.
Springer-Verlag, New York, 1977. 146 p, 31 fig, 22 tab, 152 ref.

Descriptors: *Forests, *Ecosystems, *Geochemistry, *Biology, *Ecological effects, Hydrology, Streams, Watershed management, Watersheds(Basins), Drainage, Precipitation, Gases, Dynamics.

An in-depth analysis is presented of the biogeochemistry of any terrestrial ecosystem based upon the well-known 'Hubbard Brook' ecosystem studies. Long-term data is brought together for precipitation, stream-water chemistry, hydrology and weathering, and, the dynamics of atmospheric gases and water as they flow through the system are considered. Illustrated are the ways in which the ecosystem is affected by the three major biogeochemical vectors of the earth; air, water, and organisms. In turn, it is shown how the system moderates and changes inputs and how it affects biogeochemical cycles by its outputs. Acid precipitation is an important example of the ways in which inadvertent human activities influence atmospheric inputs in remote areas. Ecosystem control over biogeochemical functions is highly predictable and relatively repeatable from year to year. The original data from the Hubbard Brook studies are compared with data from diverse ecosystems throughout the world. (Steiner-Mass)
W80-00328

4D. Watershed Protection

PROCEEDINGS, URBAN STORMWATER MANAGEMENT SEMINARS, ATLANTA, GEORGIA, NOVEMBER 4-6, 1975 AND DENVER, COLORADO, DECEMBER 2-4, 1975.
For primary bibliographic entry see Field 4A.
W80-00043

LAND MANAGEMENT TECHNIQUES FOR DEVELOPING AREAS,
L. D. Bartee.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p II-38-50, 1976.

Descriptors: *Land management, *Sedimentation, *Storm runoff, *Watershed management, Surface runoff, Legislation, Water pollution sources, Vegetation establishment, Land use, Erosion.

Land management techniques used by the Soil Conservation Service for developing areas which can minimize erosion and sediment problems are discussed. The Watershed Protection and Flood Prevention Program (Public Law 566) treats the watershed with conservation measures which catch and hold as much water as possible. Urban runoff can be reduced through the retention of lowlands or swamps for open space, construction of small retention dams, enlargement of ponds, and building terraces. Revegetation of disturbed areas is also considered. Two basic references: the Universal Soil Loss Equation and the Field Office Technical Guide, are described. (See also W80-00043) (Small-FRC)
W80-00053

SCS PRACTICES AS RELATED TO SEDIMENT AND EROSION CONTROL,
Soil Conservation Service, Athens, GA.
A. J. Dornbusch.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p II-56-61, 1976.

Descriptors: *Surface runoff, *Watershed management, *Erosion control, *Sedimentation, Water pollution sources, Land use, Vegetation establishment.

Soil Conservation Service practices related to sediment and erosion control for people or businesses with soil, water, and erosion problems, are discussed. The Soil Survey Report which provides mapping of soils all over the U. S., is described. The Universal Soil Loss Equation and its role in erosion control are discussed. Erosion control practices include the use of vegetation, water management through waterways, ponds, and irrigation systems. The Small Watersheds program and the Resources Development Program are briefly discussed. (See also W80-00043) (Small-FRC)
W80-00054

THE INTERGOVERNMENTAL TANGLE FACING STORMWATER CONTROL,
Environmental Protection Agency, Washington, DC. Water Planning Div.
A. B. Waldo.
In: Proceedings, Urban Stormwater Management Seminars, Atlanta, Georgia, November 4-6, 1975, and Denver, Colorado, December 2-4, 1975, p III-15-30, 1976. 1 ref.

Descriptors: *Storm water, *Urban runoff, *Watershed management, *Maryland, *Local governments, Water pollution sources, Control, Cleaning, Waste water treatment, Municipal wastes.

The stormwater management programs in Montgomery County and Prince George County in Maryland are compared and various program strategies are reviewed. The Prince George program is controlled by a planning board consisting of the Soil Conservation District, the Park and Planning Commission, the Washington Suburban Sanitary Commission, and the Department of Public Works. Montgomery County's program has been centralized within the Montgomery Soil Conservation District and incorporates long-range planning. Problems with both approaches to storm water management are reviewed. Control measures for best management practices (BMP) include street sweeping, erosion control practices, detention tanks, and catch basin cleaning. A characterization of the stormwater management problems in an area is required within the BMP concept. The role of intergovernmental cooperation in stormwater management is discussed. (See also W80-00043) (Lisk-FRC)
W80-00061

STATE/LOCAL INTERACTION IN STORMWATER MANAGEMENT,
Virginia State Water Control Board, Richmond.
For primary bibliographic entry see Field 4A.
W80-00062

LEGAL ASPECTS OF URBAN STORMWATER MANAGEMENT,
Shoemaker and Wham, Denver, CO.
For primary bibliographic entry see Field 4A.
W80-00063

LEGAL ASPECTS OF URBAN STORM WATER MANAGEMENT AND RELATED POLLUTION ABATEMENT PROBLEMS,
For primary bibliographic entry see Field 4A.
W80-00064

FINANCING STORM WATER CONTROL PROJECTS,
For primary bibliographic entry see Field 4A.
W80-00065

FINANCING STORMWATER PROJECTS,
Shoemaker and Wham, Denver, CO.

For primary bibliographic entry see Field 4A.
W80-00066

PLANNING TO NARROW THE IMPLEMENTATION GAP,
Municipality of Metropolitan Seattle-METRO, WA.
For primary bibliographic entry see Field 4A.
W80-00067

IMPLEMENTATION OF URBAN STORMWATER RUNOFF PLANS,
Southeastern Wisconsin Regional Planning Commission, Waukesha.
For primary bibliographic entry see Field 4A.
W80-00068

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

RATE OF LOSS OF AMMONIA FROM WATER TO THE ATMOSPHERE,
Canada Centre for Inland Waters, Burlington (Ontario); and National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 2K.
W80-00075

POLYCHLORINATED BIPHENYLS AND ORGANOCHLORINE PESTICIDES IN GREAT LAKES PRECIPITATION,
Canada Centre for Inland Waters, Burlington (Ontario).
W. M. J. Strachan, and H. Huneault.
Journal of Great Lakes Research, Vol. 5, No. 1, p 61-68, 1979. 1 fig, 7 tab, 36 ref.

Descriptors: *Chemistry of precipitation, *Polychlorinated biphenyls, *Pesticides, *Great Lakes, *Canada, Sampling, Chemical analysis, Watersheds(Basins), DDT, Dieldrin, Organic pesticides, Precipitation(Atmospheric), Rain, Snow, Water pollution, Pollutants, Path of pollutants, Organochlorine pesticides.

Snow samples from the winter of 1975-6 and rain samples (7 locations) from the period May-November 1976 were collected from around the Canadian side of the Great Lakes. All were examined for polychlorinated biphenyls and a range of organochlorine pesticides. The snow samples were time-integrated, being collected in February 1976. The rain samples were collected on an event basis, using stainless steel samplers with several complete events and the intervening dry-fall frequently being included in one sample. PCBs, lindane, alpha-BHC, DDT residues, Alpha- and beta-endosulfan, dieldrin, and methoxychlor were frequently found with mean rain levels of 21, 5, 12, 3, 2, 5, 1 and 8 ng/L, respectively. Concentrations in snowmelt were generally reduced from the rain values, except for PCBs. (Sims-ISWS)
W80-00086

EXAMINATION OF OIL-CONTAINING WASTE WATERS CHEMICAL COMPOSITION AFTER THEIR TREATMENT IN AERATION TANKS,
V. A. Panova, N. S. Goriatchev, and U. U. Lurie.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 90-96, 1975. 2 fig, 4 tab.

Descriptors: *Oily water, *Oil wastes, *Organic compounds, *Pollutant identification, *Aerated lagoons, Aeration, Volatility, Analytical techniques, Chemical oxygen demand, Oil industry, Waste water treatment, Industrial wastes.

The characteristics of effluent following aeration tank treatment of oil-containing waste waters were investigated. A new system of analysis permitted the retention of volatile compounds in the waste waters for examination. Various oxygen-bearing organic compounds remained in biochemically treated waste water. The analysis extracted volatile and non-volatile acids including naphthenic and neutral compounds, such as hydrocarbons, quinones, alcohols, aldehydes, ketones, and esters; hydrophilic compounds included sugars, aminoacids, oxyacids, sulfoacids, and polyalcohols. The treated effluent contained about 10-15% of the initially present petroleum hydrocarbons and gas chromatography determined that they were compounds containing more than 14 carbon atoms in the molecule. A significant number of oxidation products remaining in the effluent contributed to the high COD of the waste water. The toxicity of the biochemically treated oil-bearing waste water was attributed to quinones, neutral compounds, mineral salts, and phenols reduced to quinones in the effluent. Increasing the detention time of the effluent was recommended. (See also W80-00097) (Lisk-FRC)
W80-00107

ALGAL ASSAYS FOR AREAS RECEIVING OR PROGRAMMED TO RECEIVE SEWAGE EFFLUENT,
Connecticut Univ., Storrs. Inst. of Water Resources.
F. R. Trainor, and J. P. Grochowski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 247, Price codes: A03 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1979. 25 p, 4 fig, 11 tab, 15 ref. OWRT A-076-CONN(1). 14-31-0001-8007.

Descriptors: *Algae, *Bioindicators, *Chlorella, *Benthic flora, Distribution, *Effluents, Tertiary treatment, *Algal assays, *Nutrient uptake, *Phosphate, Causal agent, *Concrete substrate(CACO3), Selenastrum, Ankistrodesmus, Willimantic River, Connecticut.

Field study of a section of the Willimantic River in Eagleville revealed that Ankistrodesmus and Chlorella demonstrated a unique benthic distribution in the area of the University of Connecticut sewage effluent input. Ankistrodesmus dominates the effluent pipe and Chlorella dominates the plume once the effluent enters the river. Algal assays were performed and it was concluded that the substrate (concrete) was reponsible for this distribution. More specifically CACO3 may be the causal agent in the concrete. Both organisms grew well in effluent but Ankistrodesmus growth rates were especially high in concentrated effluent. Nutrient-uptake assays were run and it was determined that Ankistrodesmus, alone or in mixed cultures with Chlorella or Selenastrum, removed the largest percentage of PO4 from the media. NO3 uptake was less conclusive due to the presence of other nitrogenous forms. Ankistrodesmus and Chlorella were grown together for 8 weeks in an attempt to determine the presence of an autoinhibitor or toxin affecting the growth rate of one or the other. No such toxin was detected. Ankistrodesmus was selected as the most suitable organism for natural tertiary treatment of wastewater because of its pollution tolerance, PO4 filtering capacity, and dominance of the study area throughout the year. (de Lara-Conn)
W80-00193

PERSPECTIVES ON LAKE ECOSYSTEM MODELING.
For primary bibliographic entry see Field 2H.
W80-00204

PREDICTIVE WATER QUALITY MODELS FOR THE GREAT LAKES: SOME CAPABILITIES AND LIMITS,
McMaster Univ., Hamilton (Ontario).
For primary bibliographic entry see Field 2H.
W80-00211

PRELIMINARY INSIGHTS INTO A THREE-DIMENSIONAL ECOLOGICAL-HYDRODYNAMIC MODEL,
Tetra Tech., Inc., Lafayette, CA.
For primary bibliographic entry see Field 2H.
W80-00214

AN ANALYSIS OF PCB IN LAKE ONTARIO USING A SIZE-DEPENDENT FOOD CHAIN MODEL,
Manhattan Coll., Bronx, NY. Dept. of Environmental Engineering and Science.
R. V. Thomann.
In: Perspectives in Lake Ecosystem Modeling. p 293-320, 1979. 11 fig, 4 tab, 38 ref.

Descriptors: *Lake Ontario, *Food chains, *Mathematical models, *Aquatic environment, *Ecosystems, *Mass balance, *Water quality, *Hazardous substances, *Organism length, *Simulation analysis, Equations, Systems analysis, Equations, Polychlorinated biphenyls, Compartment analyses, Continuous model, Toxicity, Biomass, Density function, Data analysis, Distribution, Dynamics, Excretion, Uptake rates.

Considered is the development of models for simulating the distribution and dynamics of toxic substances within an ecosystem. In order to incorporate both bioaccumulation of toxic substances directly from the water and subsequent transfer up the food chain, a mass balance model is constructed that introduces organism size as an additional independent variable. The model represents an ecological continuum through size dependence; classical compartment analyses are therefore a special case of the continuous model. The principal factors that influence the total toxicant concentration in various regions of the food chain include excretion and uptake rates, the rate of decrease of biomass density with organism size and the food chain transfer velocity, a parameter reflecting average predation along the food chain. The model behaves linearly with respect to external mass loading of the toxicant and hence can be used in principal to estimate the input that can be allowed without exceeding given levels in various regions of trophic space. The analysis of some PCB data from Lake Ontario is used as an illustration of the theory. The introduction of organism size as an independent variable in the mass balance of a toxicant provides a generalized analysis framework; this permits the integrated use of diverse laboratory experiments on uptake and excretion as well as an interpretive framework for field data of toxicant concentrations. (See also W80-00204) (Bell-Graf--Cornell)
W80-00216

VIRUS CONSIDERATION IN LAND DISPOSAL OF SEWAGE EFFLUENTS AND SLUDGE,
Epidemiology Research Center, Tampa, FL. Dept. of Health and Rehabilitative Services.
F. M. Wellings, A. L. Lewis, C. W. Mountain, and L. M. Stark.
Florida Scientist, Vol. 38, No. 4, p 202-207, 1975. 1 fig, 2 tab, 11 ref.

Descriptors: *Viruses, *Sewage effluents, *Sewage sludge, *Public health, Sludge, Sewage disposal, Disposal, Soil, Soil contamination, Potable water, Water pollution, Water quality.

Laboratory and field experiments prove that virus does percolate through soils, is adsorbed by the soil, can be described, moves with the subsurface waters, and can survive in the soil for at least 28 days. This documentation of virus survival and movement in the terrestrial environment warrants concern over the threat to public health posed by disposal of man's biological wastes. (Bollinger-Mass)
W80-00306

ORGANOCHLORINE INSECTICIDES AND PCB IN SURFICIAL SEDIMENTS (1968) AND SEDIMENT CORES (1976) FROM LAKE ONTARIO,
Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.
R. Frank, R. L. Thomas, M. Holdrinet, A. L. W. Kemp, and H. E. Braun.
Journal of Great Lakes Research, Vol. 5, No. 1, p

18-27, 1979. 5 fig, 6 tab, 19 ref.

Descriptors: *Insecticides, *Polychlorinated biphenyls, *Lake Ontario, *Sediments, Sampling, Pollutants, Chemical analysis, Pesticides, Dieldrin, DDT, DDE, DDD, Chlorinated hydrocarbon pesticides, Bottom sediments, Lakes, Lake sediments, Sedimentation, Sedimentation rates, Sedimentology.

Surficial sediments were collected in 1968 and core sediments in 1976 from Lake Ontario. These were analyzed for organochlorine insecticides and PCB. Residues of organochlorine compounds were higher in the 3 Ontario depositional basins than in sediment in the non-depositional zones. PCB was present at the highest concentration, with mean levels of 57 ppb for the whole lake. Residues of PCB in the three basins exhibited only minimal differences. Sigma DDT was the second most frequently found contaminant. Both parent DDT and its 2 metabolites were present in sediment, giving a mean residue of 42.8 ppb for the whole lake. Differences in residues for the 3 basins were again minimal. DDT was present in sediments estimated to be deposited between 1958 and 1976. HEOD was present in only 40% of sediments, and the mean residue for the whole lake was 0.6 ppb. The Niagara basin contained mean residues (1.4 ppm) of HEOD much above the other basins. Chlordane was virtually absent from the lake in the sediments collected in 1968 but appeared in cores between 1964-1976. Endosulfan appeared in lake sediments as a spill of deck cargo at a location in the Niagara basin. This spill dispersed with the current down the south shore to deposit in the Rochester basin. (Sims-ISWS)
W80-00341

EFFECTS OF ACIDIC PRECIPITATION ON PRECAMBRIAN FRESHWATERS IN SOUTHERN ONTARIO,
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
W. A. Scheider, D. S. Jeffries, and P. J. Dillon.
Journal of Great Lakes Research, Vol. 5, No. 1, p 45-51, 1979. 5 fig, 4 tab, 18 ref.

Descriptors: *Chemistry of precipitation, *Acidic water, *Water chemistry, *Canada, Precipitation(Atmospheric), Rainfall, Lakes, Streams, Sampling, Chemical analysis, Hydrogen ion concentration, Alkalinity, Acidity, Acids, Water pollution, Water pollution control, Mercury, Fish, Pollutants, Meteorology, Acidic rainfall.

The pH of precipitation falling on the Precambrian Shield of south-central Ontario averages 4.0-4.2, as low or lower than that of precipitation in areas of the world with recognized problems of acidification of freshwaters. The area is underlain by noncalcareous bedrock of low solubility with a thin glacial overburden, and consequently many lakes have low buffering capacities. Some lakes and streams have had their pH's reduced by acidic precipitation, especially during spring runoff and after storm events. The pH of some lakes is 5.0-5.5, a level at which the reproductive success of certain fish species is impaired. Walleye of the same length show higher Hg levels in low alkalinity (less than 300 micro eq/L) waters compared to higher alkalinity waters. (Sims-ISWS)
W80-00344

SURFACE LOADING FROM POLLUTANTS IN PRECIPITATION IN SOUTHERN ONTARIO: SOME CLIMATIC AND STATISTICAL ASPECTS,
Windsor Univ. (Ontario). Dept. of Geography.
M. Sanderson, and P. D. LaValle.
Journal of Great Lakes Research, Vol. 5, No. 1, p 52-60, 1979. 4 fig, 5 tab, 19 ref.

Descriptors: *Chemistry of precipitation, *Pollutants, *Water pollution sources, *Surface waters, *Canada, Sampling, Chemicals, Chemical analysis, Precipitation(Atmospheric), Sulphates, Nitrogen, Phosphates, Chlorides, Calcium, Sodium, Potassium, Magnesium, Heavy metals, Polychlorinated biphenyls, Path of pollutants, Water pollution.

Monthly samples of precipitation during the period June 1975 to June 1977 from bulk type precipitation gauges located in 6 watersheds in southern Ontario were analyzed for sulphate, nitrogen, phosphate, chloride, calcium, sodium, potassium, magnesium, heavy metals, and PCBs. The relationship between the surface loading of the pollutant and the amount of precipitation during the observation period was investigated, and a significant relationship at the 0.05 level was found for all pollutants except sodium. The loadings in g/ha/d were tested statistically for spatial and temporal variability. All parameter loadings showed a downward trend over time, and it was suggested that this is due to decreased precipitation during the second year of observation. No significant seasonal differences were found in the surface loadings. Analysis of variance tests indicated that at the 0.05 level of significance, no significant differences in monthly loadings were observed for all parameters except calcium and magnesium, although some locations were very near and others hundreds of kilometers distant from the major sources of industrial pollutants. (Sims-ISWS)
W80-00345

ACIDIFICATION OF HEADWATER STREAMS IN THE NEW JERSEY PINE BARRENS,
Pennsylvania Univ., Philadelphia. Dept. of Landscape Architecture.
For primary bibliographic entry see Field 5B.
W80-00354

DENITRIFICATION IN A SALT MARSH ECOSYSTEM,
Marine Biological Lab., Woods Hole, MA. Boston Univ. Marine Program.
For primary bibliographic entry see Field 2L.
W80-00355

TOXICITY OF 4-CHLORO-O-CRESOL TO FISH. LIGHT MICROSCOPY AND CHEMICAL ANALYSIS OF THE TISSUE,
Jyvaskyla Univ. (Finland). Dept. of Chemistry.
M. L. Hattula, H. Reunanen, V-M. Wasenius, R. Krees, and A. U. Arstila.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 508-511, 1979. 1 tab, 6 ref.

Descriptors: *Brown trout, *Pesticide residues, *Pesticide toxicity, Chlorinated hydrocarbon pesticides, Chromatography, Chemical analysis, Fish, Physiology, Herbicides, Path of pollutants, Lethal limit, Mortality, *MCPA, *Bioaccumulation, *Tissue analysis.

This study is part of a series in which the toxicity of the metabolites of MCPA (4-Chloro-2-phenoxyacetic acid) is studied in rats and fish. In the present work the acute and subchronic toxicity was studied in sea trout (Salmo trutta). In the first subchronic experiment (20 fish/aquarium, cresol concentration 0.5 and 1.0 ppm) the fish were killed after four weeks and after three weeks in the second experiment (cresol concentration 0.5, 1.0 and 1.5 ppm). For the pathological analysis the samples were taken from liver, kidney and gills from 10 specimens. All fish from water containing 0.5 ppm 4-chloro-o-cresol were histologically normal but some specimens from water containing 1.0 ppm cresol had histopathological changes. The fish from water containing 1.5 ppm cresol some changes were observed in kidneys and gills. The concentrations of 4-chloro-o-cresol in the wet tissue of the fish in the subchronic experiments are presented. (Deal-EIS)
W80-00391

THE UPTAKE OF 226RA BY PLANKTONIC ALGAE UNDER CONDITIONS OF CONTINUOUS CULTIVATION,
Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Dept. of General Public Hygiene.
B. Havlik, and J. Hanusova.
Acta hydrochimica et hydrobiologica, Vol. 7, No. 2, p 145-152, 1979. 1 fig, 6 tab, 15 ref.

Descriptors: *Radium radioisotopes, *Absorption, *Phytoplankton, Radiochemical analysis, Tracers, Scenedesmus, Plant physiology, Cyanophyta, Chlorophyta, Path of pollutants, *Bioaccumulation, *Tissue analysis, *Coelastrum, *Microcystis.

The radium accumulation in Coclastrum cambricum, Scenedesmus obliquus and Microcystis pulverea was studied under conditions of continuous cultivation at constant levels of radium in the cultivation medium. The algae were exposed to the concentrations of 30, 300 and 3000 Bq/l226Ra in the medium for a period of 14 days. It was found that radium started to accumulate immediately after its addition to the culture just as in the stationary type of cultivation. In the continuous cultivation, however, its content decreased with the length of exposure. This is due to the decreasing part of radium adsorbed on the cell surface. While in green algae the portion of radium incorporated into cells increased with the length of exposure, in blue-green algae up to 90% of radium was bound to the surface or gelatinous capsules of the cells throughout the experiment. With the three phytoplankton species used, the highest accumulation of radium (nonwashable part) was recorded in Coelastrum cambricum. A dependence of the radium accumulation on its content in the medium was observed in the species Scenedesmus obliquus. (Deal-EIS)
W80-00394

TISSUE ENZYME ACTIVITIES FOLLOWING EXPOSURE TO DIETARY MIREX IN THE CHANNEL CATFISH, ICTALURUS PUNCTATUS,
Mississippi State Univ., Mississippi State. Dept. of Biological Sciences.
F. M. McCorkle, J. E. Chambers, and J. D. Yarbrough.
Environmental Pollution, Vol. 13, p 195-199, 1979. 5 tab, 9 ref.

Descriptors: *Channel catfish, *Enzymes, *Pesticide toxicity, Chlorinated hydrocarbon pesticides, Fish physiology, Animal metabolism, Chemical analysis, Path of pollutants, Pesticide kinetics, Proteins, *Mirex, *Tissue analysis.

Young channel catfish (Ictalurus punctatus were exposed to 1, 100, 200 and 400 ppm dietary mirex. Specific activities of lactic dehydrogenase, malic dehydrogenase, glutamate pyruvate transaminase and glutamate oxaloacetate transaminase were determined in gill, brain, liver and muscle at one, two, three and four weeks. Few changes in enzyme specific activities were found which were attributable to mirex exposure. It appears that mirex, even at high dietary exposure levels, is relatively innocuous to these enzyme activities. (Deal-EIS)
W80-00395

ACCUMULATION OF CADMIUM BY DUNALIELLA TERTIOLECTA BUTCHER,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
J. R. Jennings, and P. S. Rainbow.
Journal of Plankton Research, Vol. 1, No. 1, p 67-74, 1979. 2 fig, 2 tab, 20 ref.

Descriptors: *Cadmium, *Absorption, *Phytoplankton, *Chlorophyta, Food chains, Marine algae, Cytological studies, Water chemistry, Chemical analysis, Primary productivity, Trophic level, Heavy metals, Path of pollutants, *Bioaccumulation, *Dunaliella.

Cultures of Dunaliella tertiolecta were exposed to five concentrations of cadmium in solution (0.1, 0.5, 1, 5 and 10 ppm). The accumulation of cadmium by the algae was found to have two phases, an initial rapid uptake followed by a stabilisation of the cellular cadmium levels. D. tertiolecta concentrated cadmium from solution (conc. factor approx. 1350) at exposures up to 1 ppm Cd but exposure to the higher concentrations caused no further increase in the accumulated cadmium concentration of the algae which reached a maximum at about 1.5 ug Cd mg/l Dunaliella. (Deal-EIS)
W80-00398

THE CONTRIBUTION OF AMMONIA EXCRETED BY ZOOPLANKTON TO PHYTO-

PLANKTON PRODUCTION IN NARRAGANSETT BAY,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
G. A. Vargo.
Journal of Plankton Research, Vol. 1, No. 1, p 75-84, 1979. 4 fig, 3 tab, 28 ref.

Descriptors: *Ammonia, *Zooplankton, *Primary productivity, Seasonal, Diatoms, Phytoplankton, Aquatic populations, Nitrogen, Dominant organisms, Absorption, Biomass, Growth rates, Nutrients, Chesapeake Bay, *Skeletonema.

Ammonia excreted by mixed zooplankton populations over an annual (1972-1973) cycle in Narragansett Bay varied from 0.04 to 3.21 micrograms at NH3-N/dry wt/day, exclusive to two exceptional rates measured one year apart: 11.74 and 18.39 micrograms at NH3-N mg/dry wt/day. Gross phytoplankton production integrated over the year (1972-1973) averaged 151 mg C/cubic meter/day for an 8 m water column; peaks of 332 and 905 mg C cubic meter/day occurred during the winter-spring and summer blooms, respectively. Excreted ammonia, integrated seasonally and annually, contributed only 0.2% and 4.9% of the nitrogen required for observed gross production during the winter-spring and summer blooms, respectively, and 4.4% annually. However, excreted ammonia may be an important source of the nitrogen required by Skeletonema costatum, the dominant diatom in Narragansett Bay, during the post-bloom period when 186% of the nitrogen required for its net production was met by ammonia excretion. A combination of zooplankton ammonia excretion and benthic ammonia flux contributed 22% of the nitrogen required for the annual gross production (440 g/square meter) while 51% of the nitrogen required for the net production of Skeletonema was accounted for by regenerated nitrogen. (Deal-EIS)
W80-00399

RESPONSE OF LAKE PHYTOPLANKTON COMMUNITIES TO IN SITU MANIPULATIONS OF LIGHT INTENSITY AND COLOUR,
Ottawa Univ. (Ontario). Dept. of Biology.
D. Wall, and F. Briand.
Journal of Plankton Research, Vol. 1, No. 1, p 103-112, 1979. 3 fig, 1 tab, 38 ref.

Descriptors: *Phytoplankton, *Light intensity, Light penetration, Diatoms, Chlorophyta, Dinoflagellates, Habitats, Depth, Stratification, Cyanophyta, Anabaena, Scenedesmus, Chlamydomonas, Competition, Chrysophyta.

Phytoplankton preferences for light intensity and colour were determined in field experiments using coloured plexiglass cubes suspended at different depths in Heney Lake, Quebec. Diatoms and green algae favoured intensities greater than 1% 1 sub o (surface irradiance) contrary to dinoflagellates and other flagellates that preferred lower intensity. Red radiation usually increased the relative proportion of blue-greens, diatoms and green algae, whereas it reduced that of dinoflagellates. The authors propose that differential utilization of the light gradient allows certain phytoplankton taxa to partition the water column, thereby reducing potential competition. This is supported by the general agreement between the authors' findings and the known depth distribution of algae in lakes. (Deal-EIS)
W80-00400

5B. Sources Of Pollution

ADSORPTION AND ACCUMULATION OF PESTICIDES RESIDUES AND CHLORINATED BIPHENYLS IN BOTH WILD AQUATIC VEGETATION AND RICE IN THE CAMARGUE REGION, (IN FRENCH),
Centre National de la Recherche Scientifique, Arles (France). Centre Ecologie Camargue.
A. Vaquer.
Oecologia Plantarum, Vol. 8, No. 4, p 353-365, 1973. 2 fig, 5 tab, 23 ref. (English summary).

Descriptors: *Marsh plants, *Pesticide residues, Wetlands, Pollutants, Bioindicators, Algae, Pesticide drift, Chlorinated hydrocarbon pesticides, DDT, Crops, Rice, Aquatic plants, Cattails, Pondweeds, Pesticides.

The residues from certain chlorinated chemicals present in relatively small quantities in the various aquatic habitats in the Camarque (Rhone delta) have been investigated in some aquatic and semi-aquatic plant species, including rice. These plants absorb and concentrate the products (alpha and gamma BHC, DDT, and PCB's), with accumulated levels compared with water varying between 16 and 20,000 (dry matter) according to the species. The products absorbed are not spread homogenously throughout the plant but are generally stored at higher levels in the leaves than in the roots and at the base of the stem. Likewise the concentrations in the fruit are higher than in the plant itself. Specific differences in concentrations are due to different stages of development, to the various absorbing qualities and to the metabolic activity, in particular the degradation. Because of their high accumulating capacity, algae seem to be good indicators of the degree of water pollution. (Steiner-Mass)
W80-00020

DETERMINATION OF HYDRODYNAMIC DISPERSION COEFFICIENTS USING 'INVERFC',
Punjab Agricultural Univ., Ludhiana (India). Coll. of Agricultural Engineering.
P. Basak, and V. V. N. Murty.
Journal of Hydrology, Vol. 41, No. 1/2, p 43-48, April 1979. 1 fig, 2 tab, 8 ref.

Descriptors: *Dispersion, *Analytical techniques, *Methodology, Laboratory tests, Solutes, Porous media, Mathematics, *Hydrodynamic dispersion coefficient, Breakthrough curve, Concentration, Solute transport.

For the determination of the value of the hydrodynamic dispersion coefficient in one-dimensional transport problems, explicit analytical expressions were obtained through the application of the 'inverfc' function. These expressions provide a method for quick and exact determination of the hydrodynamic dispersion coefficients with the data obtained at an arbitrary experimental point. The method thus avoids the need of obtaining the entire breakthrough curve. The validity of the procedure was established by comparing the results with those obtained from the laboratory experiments. (Singh-ISWS)
W80-00073

DEPRESSION OF PH IN LAKES AND STREAMS IN CENTRAL ONTARIO DURING SNOWMELT,
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
For primary bibliographic entry see Field 2H.
W80-00076

TRITIUM AND OXYGEN PROFILES IN THE EASTERN MEDITERRANEAN,
Laboratorio di Geologia Nucleare, Pisa (Italy).
G. Cortecci, P. Noto, and B. Tonarelli.
Tellus, Vol. 31, No. 2, p 179-183, April 1979. 3 fig, 8 ref.

Descriptors: *Water quality, *Tritium, *Surveys, On-site investigations, Dissolved oxygen, Salinity, Analytical techniques, Profiles, Foreign research, On-site data collections, Water circulation, *Mediterranean Sea, *Ionian Sea, *Sea of Crete, *Levantine Basin, *Straits of Sicily.

The tritium and oxygen concentration profiles reported were made in February and March 1974 and referred to the Straits of Sicily, the Ionian Sea, the Sea of Crete, and the Levantine Basin. In the stations southeast of Rhodes and north of Crete, the most saline waters have the highest tritium concentrations, i.e., 10.5 + or - 0.5 T.U. and 14 T.U., respectively. In the Ionian Sea and the Straits of Sicily, on the contrary, the tritium maximum lies above the salinity maximum, with values from 12 to 19 T.U. The core of the Levantine Intermediate Water shows the same tritium concentration (about 10 T.U.) from the Levantine source regions as far as the central Ionian, suggesting a fairly high westward flowrate. (Humphreys-ISWS)
W80-00078

COMPARISON OF FINITE ELEMENT AND FINITE DIFFERENCE METHODS IN THERMAL DISCHARGE INVESTIGATIONS,
McGill Univ., Montreal (Quebec).
L. D. Spraggs.
Advances in Water Resources, Vol. 2, No. 2, p 91-95, June 1979. 6 fig, 2 tab, 3 ref.

Descriptors: *Analytical techniques, *Methodology, *Thermal pollution, *Powerplants, Circulation, Water circulation, Reservoirs, Model studies, Mathematical models, Flow, Temperature, Water temperature, Cooling water, Finite element analysis, Finite difference analysis.

Ultimately, the objective of scientific research into numerical methods must be to provide workers in the field with reliable, credible tools which can be used to analyze complex problems. In the field of water resources, there is the further need to be able to assess potential environmental impacts before irreversible modifications are made to existing water systems. In addition, the analysis methodology must be credible, economical, and achievable in a reasonable period of time. In this study, the use of numerical simulation models for analyzing the impact of a proposed thermal-electric power plant on the proposed cooling reservoir was investigated. The underlying objective was to provide an estimate of the thermal regime and subsequent evaporation for a coal-fired power plant with a potential for producing 1200 MW. However, the secondary objective was to determine whether existing finite element models or existing finite difference models could be used more effectively in meeting the stringent time frame imposed on completion of the study. A comparison of the results indicated that the very simple finite element model used for this study produces information which is as good as the more sophisticated finite difference model. The velocity fields produced by the two models were nearly identical, even though two totally different approaches were used. The predicted excess temperatures for the reservoir were, in general, very close. There was some difference in the temperatures calculated for the regions away from the inlet, but this was probably due to the fact that the finite difference model had not achieved a steady state condition. (Sims-ISWS)
W80-00082

POLYCHLORINATED BIPHENYLS AND ORGANOCHLORINE PESTICIDES IN GREAT LAKES PRECIPITATION,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W80-00086

A COMPARISON OF FLUORESCEIN DYE AND ANTIBIOTIC-RESISTANT ESCHERICHIA COLI AS INDICATORS OF POLLUTION IN GROUNDWATER,
Oregon State Univ., Corvallis. Dept. of Microbiology.
For primary bibliographic entry see Field 2G.
W80-00145

A CHEMICAL ASSESSMENT OF THE PRESENT LEVELS AND SOURCES OF HYDROCARBON POLLUTANTS IN THE GEORGES BANK REGION,
Energy Resources Co., Inc., Cambridge, MA.
P. D. Boehm, W. G. Steinhauer, D. L. Fiest, and N. Mosesman.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 333-341, 1979, 6 fig, 2 tab, 33 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Water pollution sources, *Water pollution effects, Benthos, Shellfish, Environmental effects, *Outer Continental Shelf, *Georges Bank, Gulf of Maine, Hydrocarbons, Argo Merchant oil spill.

Analysis of five suites of samples covering 40 stations in the region of Georges Bank Nantucket Shoals, and the lower Gulf of Maine illustrates the ubiquite of anthropogenic hydrocarbons throughout this highly productive and heavily fished area. Petroleum compounds from a recent major oil spill (Argo Merchant) and chronic inputs from ballast washings and normal shipping traffic were evident in the water column's dissolved and particulate hydrocarbon fractions. Surface sediments contained both anthropogenic and biogenic hydrocarbons. Analyses of whole benthic invertebrates revealed sporadic but sizeable inputs of petroleum hydrocarbons to the benthic environment. These were assimilated by such edible species as sea scallops and ocean quahogs, commonly harvested in the region. (Sinha-OEIS)
W80-00157

DISTRIBUTION OF TAR AND RELATIONSHIP TO CHANGES IN INTERTIDAL ORGANISMS ON SANDY BEACHES IN SOUTHERN CALIFORNIA,
University of Southern California, Los Angeles. Inst. for Marine and Coastal Studies.
D. Straughan.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 591-601, 1979. 11 fig, 2 tab, 27 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Beaches, *Sediments, *Environmental effects, California, Intertidal areas, Water pollution sources, Water pollution effects, Seepage, *Outer Continental Shelf, *Tar, Natural seepage.

Surveys on sandy beaches for 10 years following the Santa Barbara oil spill (1969-1978) revealed that large amounts of tar are frequently found at sites adjacent to natural oil seep areas. Tar is intermittently found on most other open coast southern California beaches. This is in contrast to few records of tar on over 40 surveys at sites in the area just north of Point Conception. The sources of tar is both difficult and costly to determine. However, available information suggests that with the exception of major oil spills, most tar on the beaches originates from natural oil seeps. On the open coast beaches, the residence time of this tar appears to be short (generally days and perhaps weeks) but after exceptional storms such as those in the winters of 1969 and 1978, tar could be buried for longer periods. In most instances deeply buried tar would be removed by the approximately annual cut and fill cycle. At all sites, natural environmental variables such as sediment grain size, had a greater impact on the distribution and abundance of species than tar. Within this framework, changes in populations at Cat Harbor following contamination by wet sicky tar in early spring 1976, appear to be a response to this tar. Conservative estimates currently suggest a two-year recovery period. This may be revised after further research. (Sinha-OEIS)
W80-00173

MONITORING OF SUBSURFACE INJECTION OF WASTES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. Vecchioli.
Ground Water, Vol. 17, No. 3, p 244-249, May-June 1979. 2 fig, 1 tab, 5 ref.

Descriptors: *Injection wells, *Underground waste disposal, *Monitoring, *Observation wells, *Path of pollutants, Florida, Aquifer management, Data collections, Aquifer characteristics, Groundwater movement, Evaluation, *Pensacola(FL).

Injection of waste liquids into Florida's subsurface is physically feasible in many places but should be accompanied by monitoring of the waste-receiving aquifer system in addition to the injection facility. Monitoring of the interaction of factors including hydrogeologic conditions, well construction, waste volumes and characteristics, and potable-water sources is desirable to assure that fresh-water resources are not being adversely affected. An effective aquifer-system monitoring program includes on-site wells located close to an injection well and open to the next-higher permeable stratum, satellite wells located hundreds to several thousands of feet from an injection well and open to the receiving aquifer, and regional wells located miles from individual injection wells and open to the receiving aquifer. An extensive aquifer-system monitoring program associated with two waste-injection facilities near Pensacola, Florida, has provided data which have aided hydrologists to understand the aquifer system's response to the injection and, accordingly, to evaluate the potential for affecting the area's fresh-water resources. (Woodard-USGS)
W80-00222

THE PREVALENCE OF SUBSURFACE MIGRATION OF HAZARDOUS CHEMICAL SUBSTANCES AT SELECTED INDUSTRIAL WASTE LAND DISPOSAL SITES,
Geraghty and Miller, Inc., Port Washington, NY.
D. Miller, O. Braids, and W. Walker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 103, Price codes: A23 in paper copy, A01 in microfiche. Report EPA-SW-634, 1977. 509 p, 3 fig, 4 tab, 18 ref, 4 append.

Descriptors: *Industrial wastes, *Landfills, *Leachate, *Migration, *Hazards, Heavy metals, Arsenic compounds, Organic compounds, Lead, Chromium, Standards, Water pollution sources.

The prevalence of subsurface migration of hazardous chemical constituents was investigated at 50 land disposal sites of industrial wastes. Monitoring wells were sampled at the sites which included landfills, lagoons, and a combination of the two. At forty-three of the sites migration of heavy metals, cyanide, arsenic, selenium or organic substances was determined. Organic contaminants were present at 40 of the 50 sites and migration was confirmed at 27 sites. Heavy metals were present at 49 sites and were confirmed to have migrated at 40 sites. Selenium, arsenic, and/or cyanide were present at 37 sites and were confirmed to have migrated at 30 sites. Hazardous inorganic constituents in amounts exceeding the EPA drinking water standards were found in 26 of the monitoring wells. Selenium was the most frequent substance found to exceed limits, followed by arsenic, chromium, and lead. (Small-FRC)
W80-00248

HEAVY METALS AND WASTEWATER REUSE,
Arizona State Univ., Tempe. Dept. of Engineering.
T. E. Higgins.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Az. p 101-109, 6 tab, 9 fig, 25 ref.

Descriptors: *Heavy metals, *Chemical wastes, *Water pollution effects, *Chemical properties, *Water reuse, Water quality, Environmental effects, Chemical analysis, Waste water treatment, Groundwater recharge, Mathematical models.

The increasing reuse of wastewaters in the arid western states is analyzed in an effort to establish the long term effects of the application of heavy metal containing wastewaters to the land. Based upon a review of the literature and of solubility chemistry the following conclusions are made concerning the fate of heavy metals when wastewaters are applied to the land for irrigation and groundwater recharge: (1) an appreciable amount of heavy metals is removed in conventional wastewater treatment, (2) additional removal of heavy metals is effected when advanced wastewater treatment processes (chemical, coagulation, sediments and filtration) are used, (3) initial removal of heavy metals in wastewaters applied to land is probably by chemical precipitation and filtration, (4) additional removal of heavy metals is accomplished by absorption of soil particles; fine soils are better absorption media than coarse soils, and (5) a mathematical model could be prepared using equilibria solubility and absorption chemistry, groundwater flow theory and mass balances to predict the long-term fate of heavy metals in wastewater applied to the land. (Tickes-Arizona)
W80-00282

WATER QUALITY OF RUNOFF FROM SURFACE MINED LANDS IN NORTHERN ARIZONA,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
J. Kempf, L. Leonhart, M. Fogel, and L. Duckstein.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Az. p 146-156, 3 tab, 2 fig, 18 ref.

Descriptors: *Water quality, *Runoff, *Ponds, *Coal mines, *Environmental effects, *Strip mine wastes, *Water pollution sources, Surface runoff, Mine water, Pollutant identification, Salinity, Heavy metals, Fluorides, Sodium, Land reclamation, Planning, Watershed management, Computer models, Systems analysis, Model studies, Arizona, Black Mesa, Arizona.

Surface mining of coal in the western U.S. can cause problems of increased salinity and heavy metal contamination in runoff along with a lack of enough rainfall to sustain plant growth for reclamation. To facilitate the planning of reclamation efforts in such areas results are described of a water quality sampling experiment on the ponds and runoff at the University of Arizona Experimental Watershed on Black Mesa in northern Arizona. A systems theoretic framework is employed to model the watershed and the results of a computer simulation based on this model is used to indicate that salinity buildup could be expected over time, given a minimal change in watershed configuration, with possible development of fluoride contamination being of particular concern. Water quality tests of the pond water and runoff on Black Mesa indicated that the water is within Federal standards for drinking and irrigation, except for sodium and fluoride. It is suggested that if it is economically desirable, the collection of more data on the ponds could be used to develop a simulation model of pond subsystems along the lines of the methodology outlined in this analysis. (Tickes-Arizona)
W80-00288

SURFACE LOADING FROM POLLUTANTS IN PRECIPITATION IN SOUTHERN ONTARIO: SOME CLIMATIC AND STATISTICAL ASPECTS,
Windsor Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 5A.
W80-00345

BOD/TOC CORRELATIONS AND THEIR APPLICATION TO WATER QUALITY EVALUATION,
Waterloo Univ. Research Inst. (Ontario).
For primary bibliographic entry see Field 5D.
W80-00353

ACIDIFICATION OF HEADWATER STREAMS IN THE NEW JERSEY PINE BARRENS,
Pennsylvania Univ., Philadelphia. Dept. of Landscape Architecture.
A. H. Johnson.
Journal of Environmental Quality, Vol. 8, No. 3, p 383-386, July-September 1979. 3 fig, 4 tab, 11 ref.

Descriptors: *Acidity, *Streams, *New Jersey, Hydrogen ion concentration, Chemicals, Chemical analysis, Sampling, Runoff, Rainfall, Precipitation(Atmospheric), Pollutants, Water pol-

lution, Acids, Path of pollutants, Acid precipitation.

Sixteen years of stream pH data indicate acidification of two relatively undisturbed headwater streams of the New Jersey Pine Barrens. Average yearly stream pH decreased approximately 0.2 to 0.5 units in two small streams that have long-term records. Hydronium ion concentration was correlated with SO4 in the two headwater streams in approximately a 1:1 ratio by equivalents, suggesting that H2SO4 is an important source of the acidity. A decrease in precipitation pH over the period was suggested in the literature and may be responsible for the decreasing stream pH. (Sims-ISWS)
W80-00354

DENITRIFICATION IN A SALT MARSH ECOSYSTEM,
Marine Biological Lab., Woods Hole, MA. Boston Univ. Marine Program.
For primary bibliographic entry see Field 2L.
W80-00355

CONTRIBUTION OF URBAN RUNOFF TO HYDROCARBON POLLUTION,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Sciences.
J. V. Hunter, T. Sabatino, R. Gomperts, and M. J. MacKenzie.
Journal of the Water Pollution Control Federation, Vol. 51, No. 8, p 2129-2138, 1979. 6 fig, 7 tab, 22 ref.

Descriptors: *Urban runoff, *Organic compounds, *Water pollution sources, *Pennsylvania, On-site investigations, Data collections, Water pollution, Storm water, Chemical oxygen demand, Water sampling, Analytical techniques, Laboratory tests, Water quality, Aromatic compounds, Suspended solids, Precipitation(Atmospheric), Computer models, Hydrographs, Oil pollution, Oil wastes, Hydrograph-pollutograph, Crankcase oil.

Runoff from an urban, northern Philadelphia, Pennsylvania, area was found to contain on the average 3.69 mg/l total hydrocarbons. This concentration indicates a loading of 25.7 kg/ha/y from urban areas on the lower Delaware Estuary. Of the total hydrocarbons, 69.6% were aliphatic and 30.4% were aromatic. In addition, 86.4% were associated with the particulate materials present and only 13.6% with the soluble constituents. However, as the runoff increased, the fraction of hydrocarbons associated with the particulates also increased. No relationship was found between load and the time since prior rainfall, but a relationship was observed between runoff and load. Retention time and peak area patterns by gas chromatography indicated that crankcase oil may be the primary source of the petroleum hydrocarbons in urban runoff. (Humphreys-ISWS)
W80-00357

THERMAL ALTERATION OF GROUNDWATER CAUSED BY SEEPAGE FROM A COOLING LAKE,
Northern Cheyenne Research Project, Lame Deer, MT.
C. B. Andrews, and M. P. Anderson.
Water Resources Research, Vol. 15, No. 3, p 595-602, June 1979. 8 fig, 1 tab, 18 ref. EPA R803971020.

Descriptors: *Cooling water, *Groundwater, *Seepage, *Water temperature, Powerplants, Heated water, Infiltration, Groundwater movement, Surface waters, Rivers, Model studies, Mathematical models, On-site investigations, Temperature, Heat, Heat flow, Thermal pollution.

Groundwater temperatures in the vicinity of a 200-ma power plant cooling lake in central Wisconsin were monitored in the field for 1 year, and the response of subsurface temperatures to seasonal changes in lake and air temperatures was simulated by means of a mathematical model. The cooling lake, which has been in use since May 1975, when a 500-Mw electric generating unit began operation, loses water to the groundwater system at a rate of 20,000 cu m/d. The zone of thermally altered groundwater is confined to a relatively small area hydraulically downgradient from the cooling lake. However, the lake is situated in a groundwater discharge area, and changes in subsurface temperatures at depths less than 6 m are believed to have affected the vegetation in the thermally altered zone. The model, which couples equations describing groundwater flow with those describing heat transport in the subsurface, was used to simulate the seasonal temperature fluctuations within 7 cross sections oriented parallel to the direction of groundwater flow away from the cooling lake. Simulated temperature patterns agreed well with field data but were very sensitive to the distribution of subsurface lithologies. Results from a predictive simulation suggested that when a second 500-Mw generating unit begins operation in 1978, groundwater temperatures will increase less than 5 C at distances greater than 15 m from the cooling lake. The results of this study suggested that the potential for significant thermal alteration of surface water bodies located in groundwater discharge areas is slight. (Sims-ISWS)
W80-00358

LAGRANGIAN AND EULERIAN MEASUREMENTS OF HORIZONTAL MIXING IN THE BALTIC,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
F. Schott, and D. Quadfasel.
Tellus, Vol. 31, No. 2, p 138-144, April 1979. 1 fig, 2 tab, 15 ref. ONR N000114-75-0173.

Descriptors: *Dye dispersion, *Diffusion, *On-site tests, *Oceans, Movement, Tracers, On-site investigations, Mixing, Currents(Water), Fluctuations, Analytical techniques, Mathematical models, Rhodamine, *Baltic Sea, Diffusion coefficients, Horizontal mixing, Lagrangian measurements, Eulerian measurements.

Six dye diffusion experiments and simultaneous moored current-meter measurements with vector-averaging current meters were carried out in the Baltic surface-mixed layer on four days with different wind and surface wave conditions. These measurements were used to test the Hay-Pasquill method of calculating Lagrangian diffusion coefficients from Eulerian fluctuation measurements which has been frequently applied to meteorological but not yet to oceanographic measurements. For the fairly wide range of the experimental conditions, it was found that the Lagrangian dye diffusion coefficients and the product (overbar sq u sub E) (T sub E) of variances and integral over the autocorrelation function of the lateral Eulerian current fluctuations were significantly correlated. Due to the special circumstances of the moored current measurements, the factor relating them was not exactly the Beta of Hay-Pasquill. This factor, for the definition of the commonly used apparent diffusion coefficient, was determined as 1.4 + or - 0.4, but for diffusion coefficients more specifically related to the diffusion velocity model used in the analysis, it would be about similar to those determined in earlier meteorological work. The calculation was also done for the diffusion experiment which Kullenberg carried out in the pycnocline at about 45 m depth. There the factor was only 1/10 of that in the surface-mixed layer. This small value is due to a larger correlation time scale in the stratified part of the water column which was most likely caused by internal wave effects. (See also W78-03254) (Humphreys-ISWS)
W80-00359

TOXICITY OF 4-CHLORO-O-CRESOL TO FISH. LIGHT MICROSCOPY AND CHEMICAL ANALYSIS OF THE TISSUE,
Jyvaskyla Univ. (Finland). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W80-00391

THE UPTAKE OF 226RA BY PLANKTONIC ALGAE UNDER CONDITIONS OF CONTINUOUS CULTIVATION,
Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Dept. of General Public Hygiene.
For primary bibliographic entry see Field 5A.
W80-00394

TISSUE ENZYME ACTIVITIES FOLLOWING EXPOSURE TO DIETARY MIREX IN THE CHANNEL CATFISH, ICTALURUS PUNCTATUS,
Mississippi State Univ., Mississippi State. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-00395

EFFECT OF DISTILLERY WASTE ON SOME FRESHWATER TELEOSTS-BIOCHEMICAL STUDIES,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
S. R. Verma, A. K. Tyagi, and R. C. Dalela.
Environmental Pollution, Vol. 13, p 225-228, 1979. 2 tab, 16 ref.

Descriptors: *Enzymes, *Inhibition, *Industrial wastes, Chemical wastes, Toxicity, Freshwater fishes, Chemical analysis, Fish physiology, Animal metabolism, Phosphates, Biochemistry, Distillery wastes, *Tissue analysis.

The effect of distillery waste on the activities of alkaline and acid phosphatases in two teleost fishes, Ophiocephalus punctatus and Saccobranchus fossilis, is reported. The waste produced a significant fall in enzyme activity (alkaline and acid phosphatases) and this was more significant in liver than in kidney in both species. Further, the increase in exposure time decreased enzyme activity significantly. (Deal-EIS)
W80-00396

ACCUMULATION OF CADMIUM BY DUNALIELLA TERTIOLECTA BUTCHER,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
For primary bibliographic entry see Field 5A.
W80-00398

5C. Effects Of Pollution

COMPARISON OF DIURNAL FLUCTUATIONS OF DISSOLVED INORGANIC CARBON AND ALGAL PRODUCTIVITY ESTIMATES IN AN OLIGOTROPHIC AND MESOTROPHIC FRESHWATER ENVIRONMENT,
Rensselaer Polytechnic Inst., Troy, NY.
P. A. Amodeo, and N. L. Clesceri.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 201, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, July, 1979. 25 p, 10 fig, 37 ref. OWRT B-060-NY(1). 14-34-0001-7172.

Descriptors: *Dissolved carbon, Particulate matter, Carbon-14 technique, Manometric technique, *Freshwater lakes.

Investigation was made into factors influencing the daily periodicity of algal carbon incorporation. Carbon, in the form of dissolved CO2, is proposed as a major limiting nutrient in both an oligotrophic and mesotrophic environment. A relationship between diurnal fluctuations of DIC and algal carbon uptake is demonstrated by use of carbon-14 as a radio-carbon tracer. DIC estimates were made using a manometric technique. A possible correlation of the above fluctuations with the excretion of organic matter by algae is proposed. Work was conducted at Gull Bay, Lake George, New York and Willsboro Bay, Lake Champlain, New York.
W80-00002

CONTROL OF SALT MARSH CULICOIDES AND TABANUS LARVAE IN SMALL PLOTS WITH GRANULAR ORGANOPHOSPHORUS PESTICIDES, AND THE DIRECT EFFECT ON OTHER FAUNA,
Bridgewater State Coll., MA. Department of Biol-

ogy.
W. J. Wall, Jr., and V. M. Marganian.
Mosquito News, Vol. 33, No. 1, p 89-93, March, 1973. 2 tab, 4 ref.

Descriptors: *Salt marshes, *Organophosphorus pesticides, *Environmental effects, Diazinon, Mosquitoes, Insecticides, Insect control, Fish, Crustaceans, Plankton, Pesticide toxicity, Ecology, Massachusetts.

Granular formulations of Dursban applied at the rate of 0.2 and 0.05 pound of technical material per acre and Diazinon applied at 0.2 pound per acre to salt marsh mud significantly reduced populations of Culicoides furens and C. hollensis larvae with low mortality to other organisms. Baytex and Abate applied at 0.2 and 0.3 pound per acre, respectively, resulted in poor control of Culicoides larvae. Some dead organisms including killifish, four-spine stickleback, prawns, tanaidacean, and fiddler crabs were found in the treated and control areas and in traps placed adjacent to these areas. Plankton taken from creeks near the treated areas were not noticeably affected by the pesticides. Granular Dursban, Abate, and Diazinon applied at the rate of 0.05, 0.4 and 0.3 pounds per acre, respectively, did not appear to control Tabanus lineola, and T. nigrovittatus larvae breeding in salt marsh sod. Diazinon at 0.3 pound per acre appeared to affect killifish, while the other pesticides in the second experiment appeared to have no effect on this species. Abate and Dursban apparently did not cause a decrease in the invertebrate fauna of the treated plots, but Diazinon did. (Howard-Mass)
W80-00013

EFFECTS OF GROUND APPLICATIONS OF MALATHION ON SALTMARSH ENVIRONMENTS IN NORTHWESTERN FLORIDA,
Environmental Research Labs., Gulf Breeze, FL.
M. E. Tagatz, P. W. Borthwick, G. H. Cook, and D. L. Coppage.
Mosquito News, Vol. 35, No. 3, p 309-315, September, 1974. 4 tab, 10 ref.

Descriptors: *Salt marshes, *Insecticides, *Environmental effects, Mosquitoes, Insect control, Fish, Crustaceans, Aquatic animals, Toxicity, Persistence, Estuarine environment, Ecology, Florida.

Death due to thermal fog (420 g/ha) and ULV aerosol spray (57 g/ha) applications of malathion 95 on saltmarsh environments in northwestern Florida were not observed among confined blue crabs, grass shrimp, pink shrimp, or sheephead minnor. Brain acetylcholinesterase was not reduced in confined sheephead minnow exposed to one or more treatments. The confined animals and a species of snail contained no measurable malathion. The chemical was not detected in sediment, but concentrations as high as 4.10 ppm were found in Juncus sp., trace amounts persisting as long as 14 days. Highest concentration in marsh water after fogging was 5.2 ppb. Highest concentration after ULV spraying was 0.49 ppb. For each method of application, only trace amounts persisted in marsh water as long as 1 day. (Howard-Mass)
W80-00025

PROBLEMS AND PERSPECTIVES IN MEASURING THE SOCIAL COSTS OF OIL POLLUTION,
National Oceanic and Atmospheric Administration, Washington, DC.
N. F. Meade, and R. C. Anderson.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 59-62, 1979. 11 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Oil pollution, *Social aspects, Environmental effects, Economics, Damages, Water pollution effects, *Outer Continental Shelf, Damage assessment, Amoco Cadiz spill, Brittany Coast.

Methods must be developed for measuring the nature and extent of oil pollution damages in economic terms. This paper analyzes the problem of providing an economic measure of oil pollution damages from three perspectives: the accuracy of the measure, the cost of the assessment, and the acceptability of the measure in judicial and policy-making arenas. Although no measure of damages reviewed is without flaws, it is suggested that comprehensive damage assessments be performed for major spills while relatively crude indices of damage be developed for the more minor, chronic forms of oil pollution. As a case example of a major spill damage assessment, recent efforts supported by the National Oceanic and Atmospheric Administration to quantify damages from the Amoco Cadiz oil spill are reviewed. (Sinha-OEIS)
W80-00149

A FISHERY-OIL SPILL INTERACTION MODEL,
Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
M. Reed, and M. L. Spaulding.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 63-73, 1979. 18 fig, 1 tab, 75 ref. American Petroleum Institute, Washington, D.C. Publication, No. 4308.

Descriptors: *Oil spills, *Fisheries, *Water pollution effects, Models, Environmental effects, *Outer Continental Shelf, Georges Bank.

An oil spill behavior and fates model (see paper by P.C. Cornillon et al. elsewhere in this volume) has been coupled to a fisheries model to produce dynamic simulations of the interactive effects between an oil spill and the cod fishery on Georges Bank, with impacts being projected into the commercial catch. Four trial cases are documented: spills occurring in December and April, with and without chemical treatment. Several systems problems are discussed, along with present and anticipated efforts to bring the set of models from its current preliminary state to one in which useful inferences may be drawn. (Sinha-OEIS)
W80-00150

CHEMICAL CHARACTERIZATION OF MOUSSE AND SELECTED ENVIRONMENTAL SAMPLES FROM THE AMOCO CADIZ OIL SPILL,
New Orleans Univ., LA. Center for Bio-organic Studies.
E. B. Overton, J. R. Patel, and J. L. Laseter.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 169-175, 1979. 5 fig, 2 tab, 14 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Environmental effects, *Water pollution effects, Biota, Aromatic compounds, Sediments, Chemical analysis, *Outer Continental Shelf, Amoco Cadiz oil spill, Mousse, Photo-oxidation, Brittany.

Mousse, biota, soil, sediment and reference mousse (collected immediately adjacent to the wreck) samples were collected during and immediately after the Amoco Cadiz oil spill. A medium Arabian crude oil was used as a nonweathered control sample. The extracts were fractionated by liquid/solid chromatography and analyzed by high resolution gas chromatography and GC-MS techniques (mass spectrometry). GC-MS analysis had identified most of the major components in the 40% benzene in N-hexane fractions of the sampled. Relative concentrations of selected aromatic components in the various samples were compared using a unique three-dimensional plotting format. The presence of oxidation products from the dibenzothiophenes were characterized in methanol fractions of actual environmental samples. Laboratory experiments conducted under simulated environmental conditions suggest that these oxidized products may arise by photochemical transformations. Products were identified by GC and GC-MS techniques and representative mass spectra are included. (Sinha-OEIS)
W80-00151

ECOPHYSIOLOGICAL EFFECTS OF OIL SPILLS FROM AMOCO CADIZ ON PELAGIC COMMUNITIES--PRELIMINARY RESULTS,
Centre Oceanologique de Bretagne, Brest (France).
J. F. Samain, J. Moal, J. Y. Daniel, J. Boucher, and J. Lefevre.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 175-185, 1979. 10 fig, 7 tab, 8 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Water pollution effects, *Ecosystems, *Zooplankton, Biomass, Estuaries, Enzymes, Physiology, *Outer Continental Shelf, Amoco Cadiz spill, Artemia salina, Brittany.

First results on distribution and changes of biomass (dry weight and total soluble proteins), physiology (amylase, trypsin) and faunal compositions of zooplankton are reported for the two months following the Amoco Cadiz spill on the northern Brittany coast. A shortage of biomass in the Aber area is attributed to hydrocarbons. The low level of the mean value of biomass on the north coasts, and the peculiarities at the estuarine station on Lannion Bay and the Trieux area are reported and discussed. (Sinha-OEIS)
W80-00152

OCCURRENCE OF OIL IN OFFSHORE BOTTOM SEDIMENTS AT THE AMOCO CADIZ OIL SPILL SITE,
Centre Oceanologique de Bretagne, Brest (France).
L. D'Ozouville, M. O. Hayes, E. R. Gundlach, W. J. Sexton, and J. Michel.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 187-192, 1979, 6 fig, 12 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Bottom sediments, *Oil pollution, Water pollution effects, Environmental effects, *Outer Continental Shelf, Amoco Cadiz Oil spill, Brittany.

A diving survey was undertaken during August 1978 to ascertain the vertical and horizontal distribution of oil incorporated into bottom sediments of the bays of Morlaix and Lannion within the Amoco Cadiz spill site of Brittany, France. A total of 80 hand-held, 15-cm-long box cores was taken at 20 stations and analyzed for visual oil content and sedimentary characteristics. Chemical samples also were taken and now are being analyzed. Preliminary investigation revealed a significant amount of oil incorporated into the bottom sediments within both areas, although the mechanisms of deposition probably were different. Generally higher oil concentrations were found in muddy sediments, sediments containing Lithothamnium, and in samples taken offshore of heavily oiled beaches. The depth of oil penetration was usually less than 7 cm (possibly related to the depth of biological reworking), except in the more porous Lithothamnium sediments, or in those areas close to heavily oiled beaches. Hand-held box coring techniques are more advantageous than other shipboard methods in that the problems associated with grab sampling are avoided, and complete control is maintained over the sample at all times. In addition, direct observations of bottom sediment variability and visible oil accumulation can be made. (Sinha-OEIS)
W80-00153

ROLE OF DYNAMIC COASTAL PROCESSES IN THE IMPACT AND DISPERSAL OF THE AMOCO CADIZ OIL SPILL (MARCH 1978) BRITTANY, FRANCE,
South Carolina Univ., Columbia. Dept. of Geology.
M. O. Hayes, E. R. Gundlach, and L. D'Ozouville.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 193-198, 1979, 6 fig, 1 tab, 7 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, Coasts, *Geomorphology, Environmental effects, Sedimentation, Dispersion, Water pollution effects, *Outer Continental Shelf, Amoco Cadiz Oil Spill, Brittany, Coastal processes, Vulnerability index.

Between 60,000 and 65,000 tons of the Amoco Cadiz oil came ashore along approximately 70 km of the shoreline of Brittany during the first few weeks of the spill. The details of oil erosion and burial were determined by resurveying 19 permanent beach profiles established during the first few days of the spill. These stations, plus an additional 147 beach observation stations, were revisited one month after the spill. Coastal processes and geomorphology played a major role in the dispersal and accumulation of the oil once it came onshore. For example, oil accumulated at the heads of crenulate bays and on tombolos (sand spits formed in the lee of offshore islands). Local sinks, such as scour pits around boulders, bar troughs (runnels), marsh pools, and joints and crevasses in rocks, tended to trap oil. Classification of the coastal environments of the Amoco Cadiz oil spill site, according to an oil spill vulnerability index (scale of 1-10 on basis of potential oil spill damage), revealed a good correlation with earlier findings at the Metula and Urquiola oil spill sites. These observations provide encouragement and incentive to continue to apply the vulnerability index to areas in the United States threatened by potential oil spills. (Sinha-OEIS)
W80-00154

TEN-YEAR OVERVIEW OF OIL SPILL CLEAN-UP AT SEA,
International Tanker Owners Pollution Federation Ltd., London (England).
I. C. White, J. A. Nichols, and M. J. Garnett.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 247-251, 1979. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Environmental effects, *Water pollution effects, Coasts, Shores, Fisheries, Ecology, *Outer Continental Shelf, Clean-up damages, Damage assessment.

The aim of this paper is to illustrate, by reference to experience gained from attendance on-site at major oil spills around the world, that the capability to combat oil on the high seas has improved little over the past ten years. Too often this failure has resulted in considerable areas of shoreline being severely oiled, damage being caused to areas of ecological, fishery, or amenity importance and has necessitated expensive clean-up measures being adopted that have on occasions been more damaging than the oil itself. The response options available for dealing with oil spills and their limitations are discussed and the importance of thorough and rapid evaluation to ensure that the response adopted is appropriate to the particular circumstances of the incident is emphasised. Also stressed is the necessity for good contingency planning, organisation and control. (Sinha-OEIS)
W80-00155

IMPACT OF DISPERSANT USE DURING THE BRAZILIAN MARINA INCIDENT,
Environmental Protection Agency, New York.
R. T. Dewling, and C. C. Silva.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 269-276, 1979, 6 fig, 8 tab, 10 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Dispersion, *Oil pollution, *Water pollution effects, Environmental effects, Sediments, Detergents, Shores, Beaches, *Outer Continental Shelf, Dispersant impact, Brazil, Brazilian Marina.

In January 1978, the tanker Brazilian Marina, while under tow, struck rock in Sao Sebastiao Channel, Sao Paulo, Brazil, and spilled approximately 10,000 tons (3,000,000 gallons) of 31.4 API gravity Kuwait crude. Prevailing winds and currents carried the oil in a northeasterly direction, causing pollution of the coastal embayments and beach areas in the States of Sao Paulo and Rio de Janerio. In an attempt to protect recreational and other public use areas, particularly the popular beaches of Ubatuba, undiluted dispersants were applied to remove oil accumulations from the shoreline. This response action while it cosmetically removed oil from the surface of the beaches, caused the oil to penetrate more deeply into the underlying sand, thus compounding the pollution and aesthetic problems attributable to the spill incident. Preliminary follow-up studies, conducted seven months after the incident, verified the persistence of the detergent-treated oil in the beach sand. (Sinha-OEIS)
W80-00156

A CHEMICAL ASSESSMENT OF THE PRESENT LEVELS AND SOURCES OF HYDROCARBON POLLUTANTS IN THE GEORGES BANK REGION,
Energy Resources Co., Inc., Cambridge, MA.
For primary bibliographic entry see Field 5B.
W80-00157

COLD REGIONS SPILL RESPONSE,
Coast Guard, Washington, DC; and ARCTEC, Inc., Columbia, MD.
G. D. Marsh, L. A. Schultz, and F. W. DeBord.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 355-358, 1979, 1 fig, 1 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Cold regions, *Water pollution effects, Oil pollution, Ice cover, Lakes, Environmental effects, Great Lakes, Alaska, *Outer Continental Shelf, Oil removal.

A cold regions oil pollution response system was defined through an engineering and cost effectiveness analysis of six oil spill scenarios, selected to encompass the broad range of oil spill and environmental conditions likely to be encountered offshore Alaska. Also identified were modifications to the system required to extend the response capability to the northern rivers, and the northern coastal regions. Three distinctly different types of spill response operations were identified: (1) for a thick, stable, level shorefast ice situation; (2) for a dynamic, hummocky, heavily concentrated broken ice situation; (3) for the case of light broken ice and open water. The presence of ice was found to aid response efforts in some cases and to hinder or preclude response efforts in others. This paper discusses the three types of spill response required for cold regions and reviews the six Alaskan and three lower 48 scenarios used to define the system requirements. (Sinha-OEIS)
W80-00158

THE RESTORATION OF OILED SHORELINES BY THE PROPER USE OF CHEMICAL DISPERSANTS,
Exxon Research and Engineering Co., Florham Park, NJ.
G. P. Canevari.
In: Proceeding 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22 1979. p 443-446, 1979, 4 fig, 2 tab, 10 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Water pollution effects, *Shore protection, Environmental effects, Biodegradation, Weathering, Surfactants, Dispersion, *Outer Continental Shelf, Oil removal, Dispersants.

The shortcomings of the expensive mechanical cleanup methods are reviewed and the overall mechanism and technique for restoration using chemical agents are presented. Although the use of chemicals in intertidal zones has not been well accepted by some environmental and regulatory groups, there is limited documentation that use of these agents results in less environmental damage and more rapid and economical shoreline restoration than mechanical alternatives. In support of this argument, an actual instance wherein an extensive Tampa, Florida shoreline had been oiled by a spill from the S/S Delian Appolon and subsequently chemically restored, is described. Data from an oiled area, oiled and chemically cleaned area and a control (as is) area are supplied in the presentation. The implications and feasibility of simply allowing the oil to weather/biodegrade in areas where this would be permissible are discussed, as are the proper, as well as improper, applications of chemical agents for shoreline restoration. (Sinha-OEIS)
W80-00159

BEHAVIOR AND EFFECTIVENESS OF DISPERSANTS AT SEA AND AT SHORELINES,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
D. Mackay, A. Watson, C. Ng, and S. Nadeau.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 447-452, 1979. 4 fig, 1 tab, 10 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Water pollution effects, *Sediments, Shores, Beaches, Environmental effects, Wave action, Resources development, *Outer Continental Shelf, Dispersants.

A laboratory experimental program was conducted in which the aims were to investigate quantitatively the factors which influence the effectiveness of chemical dispersants (1) when applied to oil under various open sea conditions, and (2) in modifying the behavior of oil advancing on a shoreline. Open sea conditions were simulated in a previously-devised dispersant effectiveness test apparatus. The effectiveness of a dispersant was shown to be profoundly influenced by turbulence level. An approach also was made to relating the turbulence level in the apparatus to natural environmental conditions. A simulated shoreline, impacted by waves from a wave generator, was used to examined the behavior of crude oil and No. 6 fuel oil on the shorelines with and without dispersant additions. Wave action caused sand beaches to 'filter' dispersed oil from the water column, resulting in enhanced, but possible reversible, oil penetration. Larger oil particles were observed to capture sand particles and sink. Implications of the results are that in many situations the use of dispersants on oil advancing on shores or even on the shoreline itself could prove advantageous. (Sinha-OEIS)
W80-00160

DECISION CRITERIA FOR THE CHEMICAL DISPERSION OF OIL SPILLS,
Woodward-Clyde Consultants, San Francisco, CA.
R. W. Castle, and E. Schrier.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 459-463, 1979. 3 fig, 2 tab. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Dispersion, *Water pollution control, Environmental effects, Pollution abatement, *Outer Continental Shelf, Dispersants, Decision analysis.

Chemical dispersion promises to play an increasing role in the control of oil spills in the United States. The question of when and how dispersants are best used to protect the environment is the subject of considerable controversy. This controversy is generated, on one hand, by insufficient understanding of real-world dispersant effectiveness and environmental implications, and on the other, by lack of guidelines by which all relevant factors can be considered together. With time, the first aspect will ultimately be resolved. This paper presents an approach to the second. While a certain degree of pre-planning and preliminary decision-making can be accomplished, ultimate decisions to conduct chemical dispersion should be made on a case-by-case basis. Criteria for determining the acceptability of chemically treating a specific incident include human risk, feasibility and adequacy of physical control and recovery, dispersibility of the oil,

logistic considerations, and whether dispersion will achieve a reduction in environmental impacts and interference with water usage. Assessed conservatively, these criteria should provide the basis for sound and acceptable decisionmaking. As knowledge in the use of dispersants improves, the validity of decisions using these criteria is expected to improve. (Sinha-OEIS)
W80-00161

APPLICATIONS OF ECOSYSTEM ANALYSIS TO OIL SPILL IMPACT,
British Petroleum Co. Ltd., London (England).
E. B. Cowell, G. V. Cox, and G. M. Dunnet.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 517-519, 1979. 21 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Ecosystems, *Environmental effects, Water pollution effects, Ecology, Biota, *Outer Continental Shelf, Oil removal.

Ecologists need to be more involved in selection of oil spill clean-up devices, setting clean-up priorities, and evaluation of clean-up techniques. This paper outlines some basic ecological principles and stresses their proper application to minimize ecological damage and to properly evaluate that damage. (Sinha-OEIS)
W80-00162

ECOLOGICAL IMPACTS OF OIL SPILL CLEANUP: ARE THEY SIGNIFICANT,
Atlantic Richfield Co., Los Angeles, CA.
J. L. Siva.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 521-524, 1979. 38 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Environmental effects, *Water pollution effects, Ecology, Beaches, Oil pollution, *Outer Continental Shelf, Oil removal.

Clear goals are needed in formulating and applying oil spill response plans whether at the level of the individual company, the oil cleanup cooperative, or the federal or state agency. There are two primary goals which have been considered, and problems arise from the fact that, in practice, these goals may not always be compatible. The goals are: minimize the overall ecological impacts of the oil spill; and remove all visible spilled oil from the environment. This paper summarizes the findings of a task force of biologists organized by the Society of Petroleum Industry Biologists; reviews the ecological effects of various oil spill cleanup methods in several different habitat types; notes research needs; and recommends minimum-impact cleanup methods for specific environments. (Sinha-OEIS)
W80-00163

A PLAN FOR SCIENTIFIC RESPONSE TO AN OIL SPILL IN THE BEAUFORT SEA,
Fisheries and Marine Service, Winnipeg (Manitoba).
D. G. Wright.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 525-532, 1979. 3 tab, 19 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Water pollution effects, *Environmental effects, Pollution abatement, Planning, Future planning(Projected), *Outer Continental Shelf, Beaufort Sea, Oil removal, Scientific Response Plan.

In anticipation that a major oil spill could occur in the Beaufort Sea, a Scientific Response Plan has been developed. The plan consists of 28 integrated scientific studies that would be conducted to assess the immediate impact of such a spill, to provide a base for the assessment of the long-term impact of the spill and to increase the knowledge (and hence predictive capabilities) concerning the behaviour and fate of oil in Arctic marine environments. Memoranda of agreement to participate in the implementation of the plan have been signed by the participating agencies. Coordination of the Beaufort Sea Scientific Response Plan is the responsibility of Fisheries and Environment Canada, Fisheries and Marine Service. (Sinha-OEIS)
W80-00164

ARE PETROLEUM HYDROCARBONS AN IMPORTANT SOURCE OF MUTAGENS IN THE MARINE ENVIRONMENT,
Fisheries and Marine Service, St. John's (Newfoundland); and Memorial Univ. of Newfoundland, St. John's.
J. F. Payne, R. Maloney, and A. Rahimtula.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 533-536, 1979. 5 tab, 35 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Water pollution effects, *Environmental effects, Metabolism, Fish, Invertebrates, Enzymes, *Outer Continental Shelf, *Mutagens, Petroleum hydrocarbons, Polycyclic aromatic hydrocarbons.

It has now been established that the aromatic hydrocarbon hydroxylase enzyme system for activation of hydrocarbons to mutagens (and carcinogens) is present in all phyla of marine animals common to the coastal northwest Atlantic. Enzyme activity has been shown to increase in all fish species on exposure to petroleum but induction has never been observed in any invertebrate. Further studies have also been carried out on the relation between induction, hydrocarbon metabolism, and mutagen-carcinogen activation by fish liver enzymes. The Ames strains of bacteria sensitive to both frameshift and base pair substitutions have been used for mutagenesis testing. Of several different types (12) of crude and refined petroleum hydrocarbons assessed to date, only used engine oil has been observed to be mutagenic and this mutagenicity is increased in fish induced for AHH by petroleum. Evidence suggests that the mutagenic principal(s) in used engine oil is derived from gasoline combustion and thus only circumstantially related to petroleum pollution. The belief that oil-spill-derived hydrocarbons could be a primary source of mutagenic activity in the marine environment is argued. (Sinha-OEIS)
W80-00165

THE OCCURRENCE OF 'WHITE EYE SYNDROME' IN SHRIMP (PENAEUS AZTECUS),
Mississippi State Univ., Mississippi State.
C. D. Minchew, L. R. Brown, and C. M. Ladner.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 537-539, 1979. 4 fig, 1 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Shrimp, *Water pollution effects, Environmental effects, *Outer Continental Shelf, Lesions, Penaeus aztecus, White eye syndrome.

Eye lesions observed in brown shrimp (Penaeus aztecus) which were chronically exposed to low levels of Empire Mix, Nigerian, and Saudi Arabian crude oils in 150 ft x 150 ft x 8 ft estuarine pond ecosystems are described. In live specimens, the lesions appeared as circular to slightly irregular white spots. In sectioned material, the lesions were characterized by the liquefactive necrosis of the crystalline cones, ommatidia, and all associated structures. Based on the appearance of these lesions in live specimens, this condition has been designated as the 'white eye syndrome.' (Sinha-OEIS)
W80-00166

RELATIONSHIP OF HYDROCARBON SOLUBILITY TO TOXICITY IN ALGAE AND CELLULAR MEMBRANE EFFECTS,
Toronto Univ. (Ontario).
T. C. Hutchinson, J. A. Hellebust, D. Mackay, D. Tam, and P. Kauss.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 541-547, 1979. 5 fig, 22 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Toxicity, *Algae, *Water pollution effects, Membranes, Aquatic life, Environmental effects, *Outer Continental Shelf, Hydrocarbon solubility.

Toxicity has been determined in terms of the effects of hydrocarbons in solution on photosynthesis using 14C-uptake as a measure. For each hydrocarbon, it was found that the molar concentration required to cause a 50% reduction in photosynthesis could be predicted from a knowledge of its solubility alone. A regression coefficient of 0.97 was obtained on a log plot. Chlorinated hydrocarbons behaved exactly as did other hydrocarbons. The effect of adding or substracting methyl groups influenced toxicity through the effect on solubility. The linear toxicity/solubility response suggests a common mechanism of hydrocarbon action. Since hydrocarbons are lipophilic, it was hypothesized that the cellular membranes may be the site of cellular disruption. This has been tested by determining the amount of potassium and manganese leakage from algal cells, using neutron activation analysis, when exposed for a given time to equimolar concentrations of selected hydrocarbons. Loss of 14C-labeled organic material has also been determined in previously tagged cells when exposed to these hydrocarbons. The predictions seem to be very strongly borne out. Implications for the prediction of effects of oil spills on a variety of aquatic organisms are present. The less soluble hydrocarbons are the most toxic on a per mole basis. Partition coefficients appear to provide a key to the common effects. (Sinha-OEIS)
W80-00167

SENSITIVITY OF 39 ALASKAN MARINE SPECIES TO COOK INLET CRUDE OIL AND NO. 2 FUEL OIL,
National Marine Fisheries Service, Auke Bay, AK. Northwest and Alaska Fisheries Center.
S. D. Rice, A. Moles, T. L. Taylor, and J. F. Karinen.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 549-554, 1979. 1 fig, 3 tab, 11 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Aquatic life, *Oil pollution, *Water pollution effects, *Environmental effects, Alaska, Fish, Invertebrates, Intertidal areas, Bioassay, *Outer Continental Shelf, Crude oil, Fuel oil.

The sensitivities of 39 subarctic Alaskan species of marine fish and invertebrates to water-soluble fractions of Cook Inlet crude oil and No. 2 fuel oil were determined. This is the largest group of animals ever tested under similar test conditions with the same petroleum oils and analytical methods. Organisms bioassayed represent several habitats, six phyla, and 39 species including fish (9), arthropods (9), molluscs (13), echinoderms (4), annelids (2), and nemerteans (2). Sensitivities were determined by 96-hour static bioassays. Sensitive pelagic animals are not necessarily more vulnerable to oil spills than tolerant intertidal forms—oil may damage intertidal environments more easily and adverse effects may persist longer than in damaged pelagic environments. (Sinha-OEIS)
W80-00168

THE RATES OF TRANSPORT AND FATES OF PETROLEUM HYDROCARBONS IN A CONTROLLED MARINE ECOSYSTEM, AND A NOTE ON ANALYTICAL VARIABILITY,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
J. N. Gearing, P. J. Gearing, T. Wade, and J. C. Quinn.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 555-564,

1979. 8 fig, 3 tab, 20 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Ecosystems, *Water pollution effects, Environmental effects, Evaporation, Biodegradation, Sediments, *Outer Continental Shelf, Petroleum hydrocarbons, Transport mechanism, Analytical variability.

Four separate laboratories have cooperated in a study on the Marine Ecosystems Research Laboratory (MERL) tanks to which known amounts of water-accommodated No. 2 fuel oil have been added. A preliminary budget has been completed, indicating that the primary loss was to the atmosphere via evaporation. Biodegradation was important for some classes of hydrocarbons and increased with temperature and duration of oil exposure. Particulate material adsorbed hydrocarbons amounting to approximately 15% of the oil added to the tanks, and carried them to the sediment where 7-16% of the added oil was eventually found. The sedimentary hydrocarbons were depleted in low molecular weight aromatic compounds (up to three rings) relative to the original oil. An unexpected but valuable result of these studies has been a better understanding of the levels of variability to be expected when naturally inhomogeneous systems are studied by different methods in different laboratories. (Sinha-OEIS)
W80-00169

COMPARISON OF HYDROCARBONS IN BENTHIC FISH FROM COAL OIL POINT AND TANNER BANK, CALIFORNIA,
Scripps Institution of Oceanography, La Jolla, CA. Marine Biology Research Div.
S. S. Rossi, G. W. Rommel, and A. A. Benson.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 573-577, 1979. 3 fig, 4 tab, 16 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Water pollution effects, Fish, Environmental effects, California, Benthos, *Outer Continental Shelf, Hydrocarbons, Geographic variations, Sebastes sp, Citharichthys sp, Lyosetta sp.

Hydrocarbons of rockfish (Sebastes sp.), sanddab (Citharichthys sp.), and sole (Lyopsetta sp.) were analyzed by high resolution glass-capillary gas chromatography, following saponification in methanolic-KOH, extraction by n-hexane, and separation via liquid chromatography. The fish contained a wide range of hydrocarbons. Some differences between species were noted: levels of biogenic constituents decreased in the order--sanddab to rockfish to slender sole. Fish collected during the summer exhibited hydrocarbon profiles similar to those taken during winter. Gravid females were characterized by somewhat higher levels of hydrocarbons. Subtle differences were observed between fish collected near Coal Oil Point, a region of intense natural petroleum influx, and Tanner Bank, an area some 140 km offshore. Animals from Tanner Bank contained lesser amounts of hydrocarbons with biogenic components often predominating over those of petroleum origin. These data, in combination with the absence of petrogenic characteristics among resolvable hydrocarbons, suggest that samples were contaminated by low levels of weathered petroleum. The most abundant hydrocarbon was squalene, which was present in every sample. The relevance of these findings to marine pollution monitoring strategies is briefly discussed. (Sinha-OEIS)
W80-00170

COMPARATIVE UPTAKE OF NAPHTHALENES FROM WATER AND OILED SEDIMENT BY BENTHIC AMPHIPODS,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
J. W. Anderson, S. L. Kiesser, and J. W. Blaylock.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 579-584, 1979. 2 fig, 5 tab, 22 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Water pollution effects, *Environmental effects, *Sediments, Metabolism, Amphipoda, *Outer Continental Shelf, Hydrocarbons, Naphthalenes, Anonyx laticoxae.

The benthic amphipod, Anonyx laticoxae, was exposed to whole oil on sediments or water extracts of Prudhoe Bay crude oil under both static and flowing conditions. Time periods of exposure ranged from 4 to 27 days and, while a range of compounds was present, the only class measured in water, tissues, and sediments was naphthalenes. Compared to levels in the surrounding environment (sediment or water) tissue magnification was least during sediment exposures (2-4 times), greatest in a flowing exposure system (approx. 1000 times), and intermediate during static water exposure (10-15 times). During a constant exposure to 22 ppb total naphthalenes (0.506 ppm total hydrocarbons) the amphipods reached a threshold of accumulation after about seven days, and the majority of contamination was from alkylnaphthalenes. Sediment exposures demonstrated relatively low bioavailability of naththalenes and the route of entry appeared to be via interstitial and water column contamination. It appears that release of naphthalenes from both oiled sediments and tissue is largely controlled by water solubilities of the components, but metabolic processes may supplement this activity. (Sinha-OEIS)
W80-00171

THE INTERACTIVE EFFECTS OF TEMPERATURE, SALINITY, AND SUBLETHAL EXPOSURE TO PHENANTHRENE, A PETROLEUM-DERIVED POLYCYCLIC AROMATIC HYDROCARBON (PAH), ON THE RESPIRATION RATE OF JUVENILE MUD CRABS, RHITHROPANOPEUS HARRISII,
Texas A and M Univ., College Station. Dept. of Biology.
R. B. Laughlin, Jr., and J. M. Neff.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 585-590, 1979. 3 fig, 2 tab, 28 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Water pollution effects, *Environmental effects, Temperature, Salinity, Crabs, Respiration, *Outer Continental Shelf, Phenanthrene, Polycyclic aromatic hydrocarbons, Rhithropanopeus harrisii.

Laboratory-reared juvenile mud crabs, Rhithropanopeus harrisii, were acclimated to temperature-salinity combinations of 20, 25, or 30 degrees C and 5, 15, or 25 parts per thousand (o/oo) salinity. Subsequently, there were exposed for 10 days to phenanthrene. This gave a complete 3 x 3 x 4 factorial design of the factor combinations. On the tenth day of phenanthrene exposure the respiration rates of the crabs were determined both at steady state with the rearing salinity, and immediately following a move from either 15 o/oo to 5 o/oo salinity (Hypoosmotic shock) or 15 o/oo to 25 o/oo salinity (hyperosmotic shock). To a certain extent, all the factors tested affected the respiration rates. An increase in temperature usually caused an increase in the respiration rate, although this was small. The juvenile crabs were tolerant both to a wide range of acclimation salinities, and to osmotic shock under control conditions. However, phenanthrene-exposed animals showed marked changes in respiration compared to controls. In moast cases, mean respiration rates of phenanthrene-exposed juveniles increase over control rates. However, the specific pattern was largely a function of all three variables tested. The percent body water of phenanthrene-exposed crabs tended to be higher than that of the controls. This may indicate that the phenanthrene-exposed animals had difficulty osmoregulating. The results of this study show that physical environmental factors such as temperature and salinity influence the nature and magnitude of the sublethal physiological response of an estuarine invertebrate to hydrocarbon pollution. (Sinha-OEIS)
W80-00172

DISTRIBUTION OF TAR AND RELATIONSHIP TO CHANGES IN INTERTIDAL ORGANISMS ON SANDY BEACHES IN SOUTHERN CALIFORNIA,
University of Southern California, Los Angeles. Inst. for Marine and Coastal Studies.
For primary bibliographic entry see Field 5B.
W80-00173

EFFECTS OF NO. 2 FUEL OIL ON CHEMICALLY-EVOKED FEEDING BEHAVIOR OF THE MUD SNAIL, ILYANASSA OBSOLETA,
Environmental Research Lab., Narragansett, RI.
J. L. Hyland, and D. C. Miller.
Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 603-607, 1979. 2 fig, 3 tab, 23 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Water pollution effects, Environmental effects, Animal behavior, Snails, Bioassay, *Outer Continental Shelf, Feeding behavior, Fuel oil, Petroleum hydrocarbons, Ilyanassa obsoleta.

Chemically-mediated feeding responses of the mud snail, Ilyanassa obsoleta, were evaluated after exposure to various fractions and concentrations of No. 2 fuel oil in a continuous flow-through seawater system. This type of feeding response involves chemical perception of and movement toward a point source of food followed by feeding through an extended proboscis. To investigate the effects of oil on this behavior, two types of bioassays were employed. In the first, arousal was used as a criterion to document effects on initial perception of food (olfaction or distance chemoreception). This initial phase of the feeding response is particularly susceptible to disruption by oil, with significant inhibition occurring after 48 hours exposure to concentrations as low as 0.015 ppm of an oil-in-water dispersion (OWD) and 0.43 ppm of the water-accommodated fraction (WAF). In the second bioassay, extension of the proboscis was used as a criterion to document effects on subsequent tasting or contact chemoreception. This later phase of feeding is less sensitive to oil, with significant inhibition occurring only after one month exposure to 0.49 ppm WAF, or after 48 hours exposure to concentrations in excess of 1 ppm (1.45 ppm OWD and 5.97 ppm WAF). Other, more obvious effects, including mortality, were observed at these to higher dose levels. This work illustrates the ability of extremely low levels of petroleum hydrocarbons to impair vital behavioral processes in marine organisms. (Sinha-OEIS)
W80-00174

HYDROCARBONS IN SEDIMENTS FROM THE EDGE OF THE BERMUDA PLATFORM,
Harvard Univ., Cambridge, MA. Div. of Applied Sciences; and Bermuda Biological Station, Ferry Reach.
T. D. Sleeter, J. N. Butler, and J. E. Barbash.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 615-620, 1979. 2 fig, 2 tab, 42 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Sediments, Water pollution effects, Environmental effects, *Outer Continental Shelf, Bermuda, Hydrocarbons, Petroleum residues.

Surficial and subsurface (10-13 cm) sediment samples were taken at 7 stations (17 cores) on the northern margin of the Bermuda seamount, remote from ship traffic, beaches, and atmospheric fallout from aircraft. Their aliphatic (pentane-extractable) hydrocarbon content was found to be very low, comparable to samples from the North Atlantic abyssal plain, and two orders of magnitude lower than for typical coastal samples. About half of the aliphatic hydrocarbons are clearly biogenic, and the remainder are characteristic of petroleum residues. Petroleum hydrocarbon concentrations are lower in subsurface than surface samples, and are lower outside the reef than inside. These results are quantitatively consistent with a diffusion model. Extremely rapid bioturbation or totally quiescent deposition on a stable sedimentary facies can prob-

ably be eliminated as hypotheses for the deposition and transport mechanism within the sediment. Whether degradation is important cannot be answered without further studies. (Sinha-OEIS)
W80-00175

MODELING THE ASSOCIATION OF PETROLEUM HYDROCARBONS AND SUB-ARCTIC SEDIMENTS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
G. Malinky, and D. G. Shaw.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 621-623, 1979. 14 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Sediments, *Water pollution effects, Path of pollutants, Model studies, Environmental effects, Alaska, *Outer Continental Shelf, Petroleum hydrocarbons.

The extent of association between labeled hydrocarbons representing the major chemical classes of petroleum, and marine suspended sediments from south-central Alaska has been investigated in a series of laboratory experiments using hydrocarbon concentrations near or below saturated solution. For a saturated solution of either an aliphatic or aromatic hydrocarbon, the concentrations of hydrocarbon in parts per million (ppm) associated with sediment is roughly 30% of the original aqueous concentration in ppm. Extrapolation of these results to permitted discharge concentrations and dilution rates encountered in south-central Alaska indicates that concentrations of hydrocarbons sorbed to sediments are in the parts per trillion (ppt) to parts per billion (ppb) range. It appears that this process cannot be a major transport pathway for the disposal of oil under the conditions investigated. (Sinha-OEIS)
W80-00176

CL5+HYDROCARBONS IN THE SEDIMENTS OF THE NEW YORK BIGHT,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
C. B. Koons, and J. P. Thomas.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 625-628, 1979. 2 fig, 1 tab, 21 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Sediments, *Water pollution effects, Environmental effects, New York, *Outer Continental Shelf, New York Bight, Cl5+hydrocarbons, Ocean dumping.

The purpose of this study was to document the distribution and abundance of C15+hydrocarbons in sediment samples taken from the Hudson River, the New York Harbor, and across the continental shelf to the continental rise. Collection of 35 of these samples took place in 1975-76 using a multiple corer, a bottom grab, or the submersible Alvin. Materials obtained from these areas were considered representative and included dredge spoils, sewage sludge, and sediment from both the Deepwater Dumpsite 106 on the continental rise and the comparatively cleaner sea floor of the continental shelf beyond the apex of the New York Bight. Total Cl5+hydrocarbons are most abundant (3000-6000 ppm) in areas highly impacted by man--harbor sediments and dredge spoil and sewage sludge disposal areas. Values from the continental shelf are lower (80 ppm) and values from the continental rise are the lowest (40 ppm). Gas chromatographic traces clearly distinguish the hydrocarbons in the dredge spoil and sewage sludge sediment samples from the hydrocarbons found in sediment samples relative free of sludge or spoil materials. (Sinha-OEIS)
W80-00177

PETROLEUM HYDROCARBONS IN THE NORTH SEA,
Institute of Marine Research, Bergen (Norway).
O. Grahl-Nielsen, K. Westrheim, and S. Wilhelmsen.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 629-632, 1979. 1 fig, 3 tab, 14 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Sampling, Water pollution, Environmental effects, Resources development, *Outer Continental Shelf, North Sea, Petroleum hydrocarbons.

Since May 1976, a number of water samples have been collected from various areas in the North Sea. Most of the samples were taken at 1 m depth, but samples were also obtained from depths down to 100 m by the use of a specially-developed water sampler. The analysis was carried out by capillary gas chromatography with a mass spectrometer as detector. By selected ion monitoring, the petrogenic hydrocarbons naphthalene, phenanthrene, and dibenzothiophene as well as their alkyl derivatives were detected. The results show that the level of non-volatile petroleum hydrocarbons in the waters of the North Sea is very low indeed. A short residence time thus keeps the standing stock of petroleum hydrocarbons below the detection limit. (Sinha-OEIS)
W80-00178

RESPONSE OF A SUBTIDAL SEDIMENT COMMUNITY TO LOW LEVELS OF OIL HYDROCARBONS IN A NORWEGIAN FJORD,
Institute of Marine Research, Bergen (Norway); and Nordic Council for Marine Biology, Blomsterdalen (Norway).
T. Bakke, and T. M. Johnsen.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 633-639, 1979. 6 fig, 1 tab, 20 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Sediments, *Benthos, On-site tests, Fjord, Nematodes, Environmental effects, Water pollution effects, *Outer Continental Shelf, Norway.

During a nine-month field experiment, an artificially enclosed portion of the community on a subtidal sandy bottom was exposed to low levels of oil hydrocarbons for periods of two weeks at six week intervals. An adjacent portion of the community acted as a control. The oil input did not result in significant accumulation of aromatic hydrocarbons in the sediment, presumably due to biodegradation and loss to the enclosure walls. The fluctuation in numbers of sediment bacterial cells did not correlate with the oil stress. Generally, the sediment chlorophyll a content was significantly higher in the oiled sediment than in the control, which indicated decreased grazing by the sediment fauna and/or increased primary production under the oil stress. The nematode abundance decreased progressively in the oiled sediment compared to a seemingly steady state in the control, whereas the harpacticoid copepods showed no response to the oil stress. No significant short term fluctuations during the exposure periods were observed in any of the groups of organisms studied. The pollution level, although chemically significant, was not considered ecologically significant with respect to the benthos. (Sinha-OEIS)
W80-00179

SELECTIVE OIL SPILL COMBAT PLANNING FOR OFFSHORE EXPLORATION AND PRODUCTION OPERATIONS IN THE NORTH SEA,
Shell Internationale Petroleum Mij, The Hague (Netherlands).
J. P. Poley.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 641-647, 1979. 5 fig, 1 tab, 8 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Oil pollution, *Water pollution effects, Resources development, Exploration, Environmental effects, Paths of pollutants, Planning, *Outer Continental Shelf, North Sea, Production operations.

Experience shows that during emergencies (Ekofisk, Amoco Cadiz) considerable differences of opinion can arise concerning the best combat-action to be taken, in spite of existing approved contingency plans. In this paper, a case is made for an improvement of the decision-making during emergencies through selective contingency planning for offshore operations. In such selective contingency planning, a spill from a specific (potential) source and its impact on a stretch of coastline are being interconnected and analysed. This will involve consideration of source-specific data (such as location, oil-composition, flow-rates, and temperatures), together with such items as estimates of the fate and movement of that oil across the intermediate stretch of sea, seasonal conditions, pollution risks in terms of oil arrival times and amounts, and coastal vulnerability. In consultation between government and industry, a scenario for action tailored to that situation then can be decided in advance, both for combat at the spill location and for coastal protection. The paper is illustrated with evidence from the Ekofisk blow-out case, and with the estimated pollution hazard for the Dutch Waddenzee from an oil blow-out in the central North Sea area. (Sinha-OEIS)
W80-00180

OIL SPILL FORECASTING--WHERE IS IT GOING,
Coast Guard Research and Development Center, Groton, CT.
I. M. Lissauer, and D. L. Murphy.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 649-652, 1 fig, 17 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Forecasting, *Model studies, *Path of pollutants, Resources development, Environmental effects, Water pollution effects, Movement, Evaporation, Dispersion, *Outer Continental Shelf, Transport models.

The methods used to forecast the movement of spilled oil have not changed significantly since the Argo Merchant spill. Little has been done to improve the deficiencies brought to light during this incident. Some of the deficiencies in the state-of-the-art are examined here, particularly those related to our incomplete knowledge of the physical mechanisms involved in oil spill movement. A basic framework for the development of an improved forecasting system is presented. It is based on the integration of a horizontal transport model, an evaporation model, and a vertical dispersion model. (Sinha-OEIS)
W80-00181

A MODEL TO FORECAST THE MOTION OF OIL ON THE SEA,
National Weather Service, Silver Spring, MD. Techniques Development Lab.; and Princeton Univ., NJ. Dept. of Civil Engineering.
K. W. Hess, and C. L. Kerr.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 653-663, 1979. 8 fig, 2 tab, 18 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Forecasting, *Model studies, *Path of pollutants, Movement, Water pollution effects, Environmental effects, Oil-water interfaces, *Outer Continental shelf.

A model to forecast the motion of oil spilled on the surface of water was established by combining separate models for the motion of oil, the motion of water, and the motion of air. The model for the motion of oil is based upon the hydrodynamic equations as they apply to oil on water. This model requires information at both the lower and upper boundaries of oil. At the oil lower boundary, the information is obtained from a model for the motion of water. This model is formulated by combining Ekman dynamics and continuity for the upper mixed layer of the sea. At the oil upper boundary, a model for the motion of air provides the required information. This model is based upon

an analysis of output obtained from one of the National Weather Service's multi-level atmospheric models. A number of case studies demonstrate the features of the separate models and the composite oil spill model. (Sinha-OEIS)
W80-00182

EFFECTS OF AN OIL SLICK ON WIND WAVES,
Flow Research Co., Kent, WA.
H-T. Liu, and J-T. Lin.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 665-674, 1979. 15 fig, 4 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Oil spills, *Waves(Water), Laboratory tests, Water pollution effects, Environmental effects, *Outer Continental Shelf, Wind waves.

Laboratory experiments were performed to investigate the effects of an oil slick on ocean waves. This is part of an integrated program aimed at understanding the vertical dispersion of oil in the upper ocean. The experiments were conducted in a wind-wave tank which measured 9.1 m long, 1.2 m wide, and 1.8 m deep. Both wind waves and mechanically-generated waves with wind were considered. No. 2 Diesel oil was fed at a rate of 0.35 liters/sec onto the water surface from the upstream end of the wave tank. To measure the wave profiles, an optical sensor-photodiode wave gauge was developed and is described herein. The effects of an oil slick on wind waves were examined in terms of wave profiles and rms wave amplitudes. For wind waves, the presence of the oil slick damps the waves significantly. The amount of damping increases with the wind speed. The rms amplitudes of the wind-generated waves increase with the fetch without the oil slick, but they do not change appreciably in the presence of the oil slick. For mechanically-generated waves with wind, wave damping by the oil slick becomes insignificant when the waves are sufficiently steep and wave breaking occurs. Prior to wave breaking, however, steepening of the wave crests due to the presence of the oil slick has been observed occasionally as a result of the reduction in the surface tension by the oil film. (Sinha-OEIS)
W80-00183

PREDICTION OF THE MOTION OF OIL SPILLS IN CANADIAN ARCTIC WATERS,
Atmospheric Environment Service, Downsview (Ontario); and Atmospheric Dynamics Corporation, Elmira, Ontario.
S. Venkkatesh, H. S. Sahota, and A. S. Rizkalla.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-23, 1979. p 677-683, 1979. 8 fig, 1 tab, 10 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Forecasting, *Model studies, *Movement, Environmental effects, Water pollution effects, On-site testing, Arctic, Cold regions, *Outer Continental Shelf, Prediction, Wind driven currents, Beaufort Sea, Bay of Fundy.

An oil spill movement prediction model operating as part of a real-time Environmental Prediction Support System for the Canadian Beaufort Sea has been developed. The present version of the model considers spills only in open waters, that is, the sea surface is considered to be ice free. The model has been partially verified with data obtained from oil simulation experiments conducted in the Bay of Fundy, off the east coast of Canada during the months of August and September, 1978. With the use of observed winds, the model-predicted locations of 'Orion' buoys used to simulate the motion of oil on water, agreed fairly well with their observed locations. These verification tests also pointed out the need for high resolution surface wind forecasts--essential data for computing wind-driven water currents which move the oil. (Sinha-OEIS)
W80-00184

OIL SPILL TREATMENT STRATEGY MODELING FOR GEORGES BANK,
Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
P. C. Cornillon, M. L. Spaulding, and K. Hansen.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 685-692, 1979. 15 fig, 3 tab, 15 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Model studies, *Fisheries, Environmental effects, Water pollution effects, Paths of pollutants, *Outer Continental Shelf, Georges Bank, Oil removal, Prediction.

As part of a larger project assessing the environmental impact of treated versus untreated oil spills, a fates model has been developed which tracks both the surface and subsurface oil. The approach used to spread, drift, and evaporate the surface slick is similar to that in most other oil spill models. The subsurface technique, however, makes use of a modified particle-in-cell method which diffuses and advects individual oil/dispersant droplets representative of a large number of similar droplets. This scheme predicts the time-dependent oil concentration distribution in the water column, which can then be employed as input to a fisheries population model. In addition to determining the fate of the untreated spill, the model also allows for chemical treatment and/or mechanical cleanup of the spilled oil. With this capability, the effectiveness of different oil spill control and removal strategies can be quantified. The model has been applied to simulate a 34,840 metric ton spill of a No. 2-type oil on Georges Bank. The concentration of oil in the water column and the surface slick trajectory are predicted as a function of time for chemically treated and untreated spills occurring in April and December. In each case, the impact on the cod fishery was determined and is described in detail in a paper by Reed and Spaulding presented at this conference. (Sinha-OEIS)
W80-00185

CHEMICAL INVESTIGATIONS OF TWO EXPERIMENTAL OIL SPILLS IN AN ESTUARINE ECOSYSTEM, PART II,
Virginia Inst. of Marine Science, Gloucester Point; and College of William and Mary, Williamsburg, VA.
R. H. Bieri, V. C. Stamoudis, and M. K. Cueman.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 693-697, 1979. 1 fig, 4 tab, 6 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Oil pollution, *Ecosystems, *Sediments, Testing, Environmental effects, Water pollution effects, Oysters, Marshes, Estuaries, Intertidal areas, *Outer Continental Shelf, Hydrocarbons, Chlorinated hydrocarbons, Aromatic hydrocarbons, Crassostrea virginica.

Hydrocarbons in unconsolidated sediment and oysters, Crassostea virginica, exposed to experimental oil spills are discussed. Quantitative data are based on high resolution, wall coated glass capillaries, and compound identification on mass spectrometry and retention. Unconsolidated sediment extracts were found to contain chlorinated hydrocarbons in concentrations of the same order of magnitude as those of aromatic hydrocarbons. While a few chlorinated hydrocarbons were also detected in oysters, their concentrations relative to aromatic hydrocarbons was low and their structure in general different from those in unconsolidated sediments. Contrary to expectations, there is no obvious correlation between unconsolidated sediment and oysters. (Sinha-OEIS)
W80-00186

SURVEY OF THE EFFECTS OF THE SETO INLAND SEA OIL SPILL IN 1974,
Tokyo Univ. (Japan). Museum.
Y. Hiyama.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 699-707, 1979. 7 fig, 7 tab, 3 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Water pollution effects, *Environmental effects, Biodegradation, Weathering, Fisheries, Sediments, *Outer Continental Shelf, Oil removal, Seto Inland Sea(Japan), Seaweeds.

On December 18, 1974, a fuel oil tank in Mizushima Refinery of Mitsubishi Oil Co. ruptured. About 50,000 barrels of fuel oil spilled and spread in the Seto Inland Sea, where there were intensive fisheries and heavy marine traffic among various industrial settlements. Coastal fisheries and fish culture fell into confusion, but, according to this survey, marine life quickly recovered by the summer of 1975 and the effect of the oil on the natural environment was not so large as suspected, the reason being mainly the quick and energetic work to recover the spilled oil. This paper is a report of the outline of the accident and a survey of its influence on the marine environment. (Sinha-OEIS)
W80-00187

HYDROCARBON DISTRIBUTION AND WEATHERING CHARACTERISTICS AT A TROPICAL OIL SPILL SITE,
Bowdoin Coll., Brunswick, ME. Marine Research Lab.
D. S. Page, D. W. Mayo, J. F. Cooley, and E. Sorenson.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 709-712, 1979. 4 fig, 2 tab, 6 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Oil pollution, *Weathering, *Tropical regions, Water pollution effects, Environmental effects, Puerto Rico, *Outer Continental Shelf, *Biogenic hydrocarbons, Carribbean, Zoe Colocotroni spill.

A study was performed on the state of an oil spill site on the southwest coast of Puerto Rico. The location of the study was Bahia Sucia, the site of the Zoe Colocotroni spill of 17 March, 1973. Particular attention was given to the weathering characteristics of the stranded oil remaining at the sites and to the presence of biogenic hydrocarbons in the sediments. It was observed that oil weathers much more rapidly in a tropical environment as compared with spills in temperate areas. Even in the most heavily impacted areas, the Zoe Colocotroni oil had weathered practically to the point of being tar. It was also observed that a tropical site has a significant chronic input of hydrocarbons from both natural and anthropogenic sources. The conclusion is that a tropical area has the potential for making a much more rapid recovery from an oil spill than a temperate one. Moreover, in assessing the effects of a tropical oil spill, care must be taken to distinguish the relative contribution to the total hydrocarbon burden in a spill area by oil, pelagic tar, and biogenic sources. (Sinha-OEIS)
W80-00188

PROBLEMS IN ECOLOGICAL MONITORING IN PORT VALDEZ, ALASKA,
British Petroleum Trading Ltd., London (England); and British Petroleum Co. Ltd., Sunbury-on-Thames (England). Research Centre.
E. B. Cowell, and D. C. Monk.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 713-717, 1979. 5 fig, 25 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil pollution, *Monitoring, *Ecology, Water pollution effects, Baseline studies, Resources development, Environmental effects, Alaska, *Outer Continental Shelf, Port Valdez(AK), Collisella pelta.

The technical and scientific problems of ecological monitoring at Port Valdez, Alaska are discussed. Particular attention is given to the lack of understanding of the processes of the Alaskan Rocky

Shore ecosystem and the paucity of data on the natural stresses controlling temporal and spatial variation in populations. In addition, taxonomic difficulties, particularly in the littoral macro-algae, further compound survey problems. The paper suggests some possible approaches that could be applied and is illustrated by data taken on baseline surveys made in 1977. Particular attention is given to unexpected age size distribution in the limpet Collisella pelta. (Sinha-OEIS)
W80-00189

THE SURVIVAL OF OIL SLICKS ON THE OCEAN AS A FUNCTION OF SEA STATE LIMIT,
Little (Arthur D.), Inc., Cambridge, MA; and Coast Guard, Washington, DC.
P. P. K. Raj, and R. A. Griffiths.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 719-724, 1979. 4 fig, 10 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Oil pollution, *Dispersion, *Path of pollutants, Water pollution effects, Environmental effects, Turbulence, Waves(Water), *Outer Continental Shelf, Sea state, Breaking waves.

A research program is underway to obtain a better understanding of the interaction between spilled oil and sea state in order to predict the dispersion and ultimate physical fate of oil spilled in rough water. In pursuit of this goal, a theoretical study and two laboratory experimental studies are now complete. As a consequence, the lower limit of sea state at which globular dispersion of oil can be effected by ocean turbulence is calculable. The formation of oil globules by breaking waves, the penetration of globules into the water column, and the distribution of oil under breaking wave generated turbulence can also be modeled. A possible mechanism by which a coherent oil slick breaks up into small patches of oil ('slicklets'), caused by breaking waves, is described, and a simplified one-dimensional model of this effect is proposed. Results indicate that a 3 meter (significant wave height) sea will tend to initiate globular vertical dispersion of oil, although this process would take place over only about 13% of the oil slick's area. To effect a horizontal surface dispersion, breaking waves with a very long crest length are necessary, a type not ordinarily found in deep water. (Sinha-OEIS)
W80-00190

A TIDAL SIMULATION SYSTEM FOR ESTUARINE ECOSYSTEM RESEARCH,
Mississippi State Univ., Mississippi State.
R. A. Johnson, L. R. Brown, and W. G. Wells.
In: Proceedings 1979 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), held in Los Angeles, California, March 19-22, 1979. p 725-728, 1979. 5 fig, 3 ref. American Petroleum Institute, Washington, D.C. Publication No. 4308.

Descriptors: *Oil spills, *Estuaries, *Ecosystems, *Tidal effects, *Testing, Water pollution effects, Environmental effects, Simulation analysis, Gulf of Mexico, *Outer Continental Shelf, US Gulf coast, Tidal Simulation System(TSS).

A system is described for simulating tidal movements in an enclosed salt-water (estuarine) environment. This Tidal Simulation System (TSS) can be programmed to deliver various tide levels on variable cycles, and can record system performance analog data output on strip charts. Employing a variable-speed centrifugal pump, a system of pneumatic valves actuated by a central timing device, a pressurization subsystem, and a special piping manifold, the system controls flow through a branched array of submerged outlet pipes which prevent disruption of surface water and oil films, and prevent disturbance of bottom sediments. The system has undergone extensive operation tests in the Ecosystem Research Laboratory of the Mississippi State University Research Center, situated at the NASA National Space Technology Laboratory (NSTL) at Bay St. Louis, Mississippi, and has been used to simulate tides in two pairs of ponds which were employed on an Environmental Protection Agency contract to study the fate and effect of oil in the aquatic environment of the Gulf Coast Region. The salinity of the ponds ranged from 6 to 12 parts per thousand (o/oo), and the composition of the plankton population changed with salinity and paralleled changes observed in the estuarine area of the south-central Gulf area. Several effects of low level oil pollution, not found in laboratory studies, were observed during the course of an eleven-month study. (Sinha-OEIS)
W80-00191

GUIDELINES FOR SURFACE WATER QUALITY, VOL. 1 INORGANIC CHEMICAL SUBSTANCES ARSENIC,
Department of the Environment, Ottawa (Ontario). Water Quality Branch.
A. Demayo, M. C. Taylor, and S. W. Reeder.
1979, 13 p, 1 fig, 97 ref, 1 append.

Descriptors: *Surface waters, *Water quality, *Inorganic compounds, *Toxicity, Vegetation, Public health, Aquatic life, Wildlife, Livestock, Irrigation water, Water utilization, Recreation.

A literature survey was carried out on the toxic effects of arsenic and arsenic compounds on human health, aquatic life, plants and livestock. The information is summarized in this publication, From it, maximum arsenic concentrations in water at which toxic effects will not appear are recommended. (WATDOC)
W80-00194

PESTICIDES MONITORING IN THE PRAIRIES OF WESTERN CANADA,
Saskatchewan Dept. of the Environment, Regina. Inland Waters Directorate.
W. D. Gummer.
Paper presented at the International Symposium on the Analysis of Hydrocarbons and Halogenated Hydrocarbons, Burlington, Ontario, May 1978. Water Quality Interpretive Report No. 4, 1979, 14 p, 4 fig, 8 tab, 35 ref.

Descriptors: *Pesticides, *Monitoring, *Surface waters, *Water quality, Aquatic habitats, Environmental effects, *Prairie, *Western Canada, Isomerization.

Pesticide monitoring programs conducted by the Water Quality Branch of the Department of the Environment during the period 1971 to 1977 revealed a widespread distribution of 2,4-D; 2,4,5-T; gamma-BHC (lindane); and alpha-BHC as well as a more limited distribution of 2,4-DP (dichloroprop); aldrin; and beta-Endosulfan in surface waters of western Canada. Atmospheric transportation and deposition are the mechanisms believed responsible for the wide distribution of lindane and alpha-BHC in western Canada. It is speculated that isomerization of lindane to the alpha-BHC isomer accounts for the abundance of alpha-BHC. Concentrations of both lindane and alpha-BHC at times exceeded 0.01 micro g per L. The herbicide, 2,4-D was prevalent in the agricultural areas at concentrations above 0.01 micro g per L and as high as 4.33 micro g per L. In addition to agriculture, industries and municipalities were found to contribute pesticides to the aquatic environment. (WATDOC)
W80-00198

BIOACCUMULATION AND TOXICITY OF HEAVY METALS AND RELATED TRACE ELEMENTS,
Geological Survey, Menlo Park, CA. Water Resources Div. and Oak Ridge National Lab., TN.
H. V. Leland, S. N. Luoma, and J. M. Fielden.
Journal of the Water Pollution Control Federation, Vol. 51, No. 6, p 1592-1616, June 1979. 3 tab, 199 ref.

Descriptors: *Reviews, *Toxicity, *Heavy metals, *Trace elements, *Aquatic life, Ecosystems, Water pollution effects, Aquatic environment, Benthic fauna, Freshwater fish, Marine fish, Estuarine fisheries, Aquatic animals, Water birds, *Literature review.

In contrast to those of the past several years, this review is confined to a discussion of bioaccumulation and toxicity of heavy metals and related trace elements. The decision to narrow the scope of the review reflects a large body of literature now available on trace element distributions and their environmental effects. Included in this review are reports dealing directly with concentrations or activities of trace elements in aquatic ecosystems and the impact of these trace constituents on aquatic life. Included is a bibliography containing 199 literature references. (Woodard-USGS)
W80-00237

REGIONAL ANALYSIS OF ECONOMIC ACTIVITY, RESOURCE MANAGEMENT AND LAKE EUTROPHICATION: A CASE STUDY OF ITASCA COUNTY, MINNESOTA,
Minnesota Univ., St. Paul. Coll. of Forestry.
A. P. O'Hayre, and A. C. Mace.
In: Watershed Management. Proceedings of a Symposium conducted by the Irrigation and Drainage Division of the American Society of Civil Engineers, Logan, Utah, August 1975. p 597-614, 1975. 4 fig, 1 tab, 17 ref. ASCE, New York, N.Y.

Descriptors: *Regional analysis, *Economic impact, *Environmental effects, *Lakes, *Eutrophication, Itasca County(MN), *Monte Carlo method, *Input-output analysis, *Watersheds(Basins), *Methodology, Simulation analysis, Urban runoff, Planning, Decision making, Water quality, Mathematical models, Systems analysis, Agricultural land, Forest land, Nutrient losses, Resource management.

To establish the link between residuals discharge and water quality criteria on a regional basis, it is necessary to consider the distribution of residuals discharge over the region and the resulting distribution in water quality. Developed is a conceptual and quantitative framework for predicting the economic and water quality effects of alternative decisions in a natural resource-based economy. The study region is Itasca County, a scenic area in north central Minnesota with a strong minerals, recreation and forest resource base. Considered is the quality of the large number of lakes in the county, including nonpoint as well as point sources of residuals. Input-output analysis is used; the approach is a simulation model for estimating direct plus indirect economic and pollution effects resulting from changes in technology or in final demand in various sectors of the economy. Essential model elements are: (1) the Leontief inverse of an input-output matrix of the economy and (2) an environmental linkages matrix showing the residuals outflow to the environment associated with one dollar of gross output of each economic sector. Monte Carlo simulation is used to derive the distribution of trophic state index and of nutrient loadings from watersheds and to describe regional lake water quality for proposed timber harvest alternatives. (Bell-Graf--Cornell)
W80-00254

THE EFFECTS ON WATER QUALITY BY MINING ACTIVITY IN THE MIAMI, ARIZONA REGION,
Arizona State Land Dept., Phoenix.
D. W. Young, and R. B. Clark.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Arizona, p 137-145, 4 fig, 2 tab, 18 ref.

Descriptors: *Water quality, *Water pollution sources, *Mine wastes, *Potable water, *Water allocation, Acid mine water, Water quality standards, Domestic water, Industrial water, Aquifer characteristics, Leachate, Social function, Economic effects, Arizona.

The town of Miami, Arizona in the southern portion of Gila County, Arizona, has been faced with ever-decreasing potable water supply problems due to the quality degradation brought about by copper mining since the late 1800s. Water quality

in this region, which is underlain by two aquifers which historically and at present serve as the principal industrial and private domestic water supply, is analyzed with the following conclusions: (1) the historic surface and underground mining activity within the region has contributed, and in all probability will continue to contribute to water quality degradation in both the flood plain and Gila Conglomerate aquifers, (2) the waters of the shallow floodplain aquifer are chronically chemically polluted and exceed USPH drinking water standards, (3) the Gila conglomerate and Pinal Schist are highly faulted throughout the region causing potential problems of acid leachate escaping, and (4) small mining communities such as the town of Miami typically have an interwoven socio-economic interdependence with large corporation mining activity. (Tickes-Arizona)
W80-00287

WATER QUALITY PROBLEMS OF THE URBAN AREA IN AN ARID ENVIRONMENT. TUCSON, ARIZONA,
Pima Association of Governments, Tucson, AZ.
G. Hansen.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Arizona, p 185-193, 1 tab, 1 fig.

Descriptors: *Urban hydrology, *Water quality, *Water pollution effects, *Water quality control, *Planning, *Pima County, Arizona, Surface runoff, Urban sociology, Regional analysis, Municipal wastes, Industrial wastes, Septic tanks, Groundwater availability, Hydrologic systems, Hydrologic cycle, Landfills, Leachate, Groundwater recharge, Aquifer systems, Water supply, Water reuse, Water harvesting, Storm runoff, Sewage effluents.

The U.S. Environmental Protection Agency's two-year 208 area-wide Water Quality Management Study for Pima County, Arizona, is discussed in terms of the specific problems of municipal wastewater effluent, industrial wastewater, urban stormwater runoff, land disposal of residual wastes, septic systems, and construction activities related to the City of Tucson urban area. The primary groundwater and the slow cycling of the hydrologic system in this arid urban environment reduce many water pollution problems to insignificant levels in the short term, (2) there does exist significant long-term pollution problems in the area. These problems include urban stormwater runoff and landfill leachate, and are related to the pollution of groundwater recharge and aquifer water supplies, and (3) there is a strong need for total water resource planning in arid urban areas which includes planning for wastewater reuse, water harvesting, and proper management of groundwater recharge systems. (Tickes-Arizona)
W80-00294

FISHERY SURVEY OF CEDAR LAKES AND THE BRAZOS AND SAN BERNARD RIVER ESTUARIES,
Texas Parks and Wildlife Dept., Austin.
For primary bibliographic entry see Field 2H.
W80-00305

VIRUS CONSIDERATION IN LAND DISPOSAL OF SEWAGE EFFLUENTS AND SLUDGE,
Epidemiology Research Center, Tampa, FL. Dept. of Health and Rehabilitative Services.
For primary bibliographic entry see Field 5A.
W80-00306

UTILIZATION OF OXYGEN MODELS IN ENVIRONMENTAL IMPACT ANALYSIS,
McMaster Univ., Hamilton (Ontario).
W. J. Snodgrass, and M. F. Holloran.
In: Water Pollution Research in Canada 1977. Proc. of Twelfth Canadian Symp. on Water Poll. Research, Univ. Toronto, Feb. 1977, and Eastern Div. Symp., Concordia Univ., Montreal, Dec. 1976, p 135-156. 7 fig, 2 tab, 14 ref.

Descriptors: *Reservoirs, *Oxygen, *Environmental effects, *Mathematical models, Simulation analysis, Aquatic environment, Measurement, Temperature, Management, Water quality, Projects, Dissolved oxygen, Sensitivity analysis, Sediments, Decision making, Prediction, Operating policy, Constraints, Fontana Reservoir(North Carolina).

A vertical one-dimensional temperature-oxygen model for reservoirs is used to estimate zones of stress on the aquatic environment of a series of reservoirs in Nova Scotia. Application to cold climates has necessitated a few novel developments for the temperature model. The oxygen model whose sinks are water column decay and sediment oxygen demand (DOS) is calibrated using under ice measurements of oxygen stocks and laboratory and in situ measurements of a zero-order kinetic model for sediment oxygen demand. These extensive studies are complementary and indicate a winter SOD of 0.1 gm O2/m2/day and a higher summer value. High epilimnetic temperatures coupled with the predicted anoxic zones in lower waters cause a major stress upon fisheries potential. This model provides a tool for determining the effects of different reservoir management strategies upon water quality and for selecting among these strategies. (Bell-Graf--Cornell)
W80-00312

EFFECTS OF ACIDIC PRECIPITATION ON PRECAMBRIAN FRESHWATERS IN SOUTHERN ONTARIO,
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
For primary bibliographic entry see Field 5A.
W80-00344

TOXICITY OF 4-CHLORO-O-CRESOL TO FISH. LIGHT MICROSCOPY AND CHEMICAL ANALYSIS OF THE TISSUE,
Jyvaskyla Univ. (Finland). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W80-00391

PESTICIDE INDUCED HAEMATOLOGICAL ALTERATIONS IN A FRESH WATER FISH SACCOBRANCHUS FOSSILIS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
S. R. Verma, S. K. Bansal, A. K. Gupta, and R. C. Dalela.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 467-474, 1979. 2 tab, 24 ref.

Descriptors: *Pesticide toxicity, *Fish physiology, Teleosts, Chlorinated hydrocarbon pesticides, Animal metabolism, Biochemistry, Chemical analysis, Protein, Calcium, Magnesium, Sodium, Iron, Chlorides, *Chlordane, *Tissue analysis, *Hematology.

The effect of chlordane on hematological parameters in the freshwater teleost, Saccobranchus fossilis, was investigated. Fish were exposed to 0.12 mg/L chlordane for 60 days. Blood samples were taken at 15 day intervals. Several factors like haemoglobin percentage, RBC, WBC, and hematocrit value (PCV) were found increased while erythrocyte sedimentation rate (ESR) and clotting time were found decreased. It was also observed that out of the 12 blood constituents analysed, glucose, lactate, non-protein nitrogen, sodium, potassium, calcium, magnesium, iron and chloride increased while other two i.e. proteins and cholesterol decreased after exposure to pesticide. (Deal-EIS)
W80-00392

TISSUE ENZYME ACTIVITIES FOLLOWING EXPOSURE TO DIETARY MIREX IN THE CHANNEL CATFISH, ICTALURUS PUNCTATUS,
Mississippi State Univ., Mississippi State. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-00395

EFFECT OF DISTILLERY WASTE ON SOME FRESHWATER TELEOSTS-BIOCHEMICAL STUDIES,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-00396

ACCUMULATION OF CADMIUM BY DUNALIELLA TERTIOLECTA BUTCHER,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
For primary bibliographic entry see Field 5A.
W80-00398

5D. Waste Treatment Processes

PROCESS FOR TREATMENT OF SEWAGE IN A GRAVITY SEWER,
K. C. Smith.
U.S. Patent No. 4,148,726, 4 p, 1 fig, 12 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 2, p 603, April 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Oxygenation, Odor, Sewers, Oxygen, Hydrogen sulfide, Equipment.

Pure oxygen or a gas containing more oxygen than air is injected under pressure into sewage held in or flowing through a sewer. This injection can be used to prevent the concentration of dissolved oxygen in the sewer falling to a level at which there occurs bacterial reduction to hydrogen sulfide of sulfate present in the sewage. The injection can also be used to oxidize to sulfur any sulfide dissolved in the sewage. The pure oxygen or the gas containing more oxygen than air may be injected into sewage flowing through a sewage pipe forming part of a gravity sewer, into a pump used to transfer the sewage through the sewer, or into a part of the sewer where sewage is collected before being transferred through the sewer. (Sinha-OEIS)
W80-00008

A COST-EFFECTIVE SWIRL COMBINED SEWER OVERFLOW REGULATOR/SOLIDS-SEPARATOR,
Municipal Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 4A.
W80-00057

2ND USA/USSR SYMPOSIUM ON PHYSICAL/CHEMICAL TREATMENT FROM MUNICIPAL AND INDUSTRIAL SOURCES, HELD AT THE TAFT CENTER, CINCINNATI, OHIO, NOVEMBER 12-14, 1975.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 702, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency, Washington, DC. 1975. 177 p.

Descriptors: *Chemical reactions, *Treatment, *Physicochemical properties, *Chemical industry, Oil industry, Municipal wastes, Sewage treatment, Sludge treatment, Waste water treatment, Tertiary treatment, Industrial wastes.

The application of physical-chemical treatment of wastes from municipal and industrial sources was discussed at the second cooperative symposium attended by delegations from the U.S. and the USSR. A total of 18 papers were included in the proceedings. Research and development, applications, economics, full-scale data and other aspects of physical-chemical treatment of municipal and industrial waste waters are included. (See also W80-00098 thru W80-00115) (Lisk-FRC)
W80-00097

OVERVIEW OF PHYSICAL-CHEMICAL TREATMENT,
J. M. Cohen, and J. J. Westrick.
In: 2nd USA/USSR Symposium on Physical/

Chemical treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 4-13, 1975. 8 fig, 8 tab, 24 ref.

Descriptors: *Lime, *Activated carbon, Biological treatment, *Chemical reactions, *Filtration, Suspended solids, Municipal wastes, Waste water treatment.

The methods of physical-chemical treatment of municipal waste water are reviewed. Chemical clarification, in which the waste water is mixed with chemicals in a rapid mix basin followed by gentle stirring in a basin for a retention time of 10-15 min, includes one or more of the following: lime, salts of iron and aluminum, and organic polymers. Clarification reduces organic matter, suspended solids, and phosphates by 70-98%. Suspended solids remaining in effluents following physical-chemical treatment may be removed by granulated media filtration, especially granular activated carbon filtration. A model for maximizing carbon utilization is described and biological activity and carbon regeneration are reviewed. Powdered activated carbon systems are evaluated and their utilization and regeneration are described. The application and performance of physical-chemical treatment systems are reviewed. (See also W80-00097) (Lisk-FRC)
W80-00098

STUDIES ON WASTEWATER TREATMENT WITH FLOCCULANTS APPLICATION,
I. N. Maysnikov, L. V. Gandurina, and I. N. Butzeva.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 14-19, 1975. 6 tab.

Descriptors: *Flocculation, *Coagulation, *Minerals, *Polyelectrolytes, *Sewage treatment, Oily water, Chemical oxygen demand, Suspended solids, Separation techniques, Waste water treatment, Municipal wastes.

A study of waste water treatments with the application of flocculants and their combinations with mineral coagulants was performed with chemical, petroleum chemical, and pulp and paper effluents. The separation of solids and liquids by settling, filtration and compression flotation, and a study of water soluble cationic flocculants were performed. The coagulants studied included aluminum sulfate and the polyelectrolytes of highly molecular pyridine salts on a vinylpyridine base. Thus, sewage with a COD of 558 mg/liter, 64 mg/liter of suspended solids, and 40.8 mg/liter of oil products were reduced by 80%, 93.2%, and 73%, respectively. The use of 50 mg/liter of aluminum sulfate and 2 mg/liter flocculant was considered feasible. Coagulated waste water treatment tests were also tested with settling and compression settling. Polyelectrolyte treatment of sewages with different compositions was considered suitable despite the higher costs. Coagulant dosages of 2-10 mg/liter resulted in increased sewage treatment rates; the optimum sulfate aluminum content was considered to be 10 mg/liter. (See also W80-00097) (Lisk-FRC)
W80-00099

THE OPERATION OF THE PHYSICAL-CHEMICAL PLANT AT ROSEMOUNT, MINNESOTA,
R. Polta.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 20-30, 1975. 10 fig, 5 tab, 2 ref.

Descriptors: *Tertiary treatment, *Treatment facilities, *Activated carbon, *Ion exchange, *Lime, Chlorine, Suspended solids, Ammonia, Zeolites, Filters, Phosphorus, Waste water treatment, Municipal wastes.

Physical/chemical treatment was selected for a 0.6 mgd municipal waste water treatment plant constructed in Rosemount, Minnesota. The advanced treatment plant incorporates contact clarification, two dual media filters for suspended solids removal, three granular activated carbon columns for soluble organics removal, two secondary dual media filters, and clinoptilolite ion exchange columns for ammonia nitrogen removal. Off line processes include the chemical feed systems which supply lime, ferric chloride, polymer, and chlorine, the activated carbon regeneration system, and the zeolite regeneration system for the ion exchange column. The advanced treatment plant reduces suspended solids to 5 mg/liter, BOD to 10 mg/liter, and total phosphorus to 1 mg/liter. (See also W80-00097) (Lisk-FRC)
W80-00100

TREATMENT OF CHEMICAL PLANT EFFLUENTS,
M. N. Levchenko.
In: 2nd UDA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 31-34, 1975.

Descriptors: *Chemical wastes, *Chemical industry, *Sewage treatment, *Industrial water, *Recirculated water, Biological treatment, Filtration, Recycling, Industrial wastes, Municipal wastes, Waste water treatment, Water reuse.

Chemical plants in the USSR providing biochemical treatment of combined industrial and municipal effluents and reuse of treated effluents as process water are reviewed. Industrial and sewage effluents are treated at a 100,000 cu m/day plant with biological and mechanical treatment followed by treatment in buffer ponds prior to ozonation and recycling of the treated water to the industrial process. A synthetic fiber plant has a treatment capacity of 80,000 cu m/day where effluents receive biological treatment followed by three-step cascade bioponds; effluents are recycled to the process water. A nitrogen plant further treats biologically treated effluents with a two-step filter system incorporating filter cloth filters and sand filters. Waste waters unfit for recycling are classified as: organic polluted, mineral polluted containing > 3 g/liter or < 3 g/liter, and sewage. Mineral polluted water with > 3 g/liter is treated with 7-step evaporation in vertical film-type vessels; water with less than 3 g/liter mineral content is treated in buffer ponds. Sewage and organic polluted waste water receive biological and mechanical treatment followed by buffer pond treatment. Further treatment of buffer pond effluent is described. Water supply routes at chemical plants are also described. (See also W80-00097) (Lisk-FRC)
W80-00101

THE ROLE OF ACTIVATED CARBON IN PHYSICO-CHEMICAL TREATMENT,
Michigan Univ., Ann Arbor. Coll. of Engineering.
W. J. Weber.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 35-49, 1975. 4 fig, 5 tab, 21 ref.

Descriptors: *Activated carbon, *Physical properties, *Chemical properties, *Surfaces, *Adsorption, Porosity, Waste water treatment, Industrial wastes, Municipal wastes, Granules, Particle size.

The various properties and uses of activated carbon for the physical-chemical treatment of wastes are examined. Activated carbon may be prepared by the carbonization of vegetable substances impregnated with metallic chlorides or by the activation of charcoal with carbon dioxide and steam at high temperatures. Porosity is generated by the action of dehydrating chemicals or by the action of oxidizing gases evolved in the process. The surface area of activated carbon usually ranges from 450-1500 sq m/g, except bone charcoal which has about 100 sq m/g surface area. Methods of measuring the physical properties of activated carbon are reviewed. The type of reactor system for contacting the carbon with the waste water is of particular significance in large-scale treatment systems. The various types of contact processes and reactors are illustrated and described. The types of systems for the activated carbon treatment of municipal and industrial waste waters are reviewed, and the operating results from several pilot physicochemical treatment plants are provided. Thermal regeneration of activated carbon is discussed. (See also W80-00097) (Lisk-FRC)
W80-00102

THE REMOVAL OF VOLATILE SUSPENDED SOLIDS FROM WASTEWATERS,
I. N. Miasnikov, and B. A. Balakin.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 50-57, 1975. 3 fig, 1 tab.

Descriptors: *Gases, *Volatility, *Nozzles, *Evaporation, *Spraying, Hydrogen sulfide, Chemical wastes, Pulp wastes, Waste water treatment, Industrial wastes.

Apparatuses for the degassing of waste waters are described and evaluated. Natural degassing through the use of open water surfaces at treatment facilities has an efficiency of 50-60%. Water blow-off with air in open channels and settling tanks results in blow-off products entering the atmosphere. Separate streams of waste waters and process solutions may be degassed with a chord nozzle, a nozzle of Raschig's rings, and hollow spraying desorbers. For abrasive industrial wastes, the use of the nozzle of Racshig's rings for degassing from hydrogen sulfide is about 95%; nozzle-type and cascade-type apparatuses are also suitable for removing hydrogen sulfide, mercaptan, dimethyl sulfide, and dimethyl disulfide from pulp and paper waste waters. Boiling is used for liquid wastes; chlorination also removes certain organic contaminants. Desorption in the nozzle-type apparatus of Raschig's rings, in the apparatus with a barbotage layer of liquid, and in spraying apparatuses is described in detail. (See also W80-00097) (Lisk-FRC)
W80-00103

DESIGN OF FACILITIES FOR PHYSICAL-CHEMICAL TREATMENT OF RAW WASTEWATER,
G. L. Culp.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 58-75, 1975. 7 fig, 6 tab, 15 ref.

Descriptors: *Coagulation, *Adsorption, *Activated carbon, *Design criteria, *Treatment facilities, Filtration, Polymers, Lime, Flocculation, Wastewater treatment, Municipal wastes.

Design parameters for the unit processes in the physical-chemical treatment of raw wastes, design criteria for specific waste water characteristics, criteria utilized for full-scale plants, and data from actual plants are presented. The coagulants reviewed include polymers, iron salts, aluminum salts, and lime; a comparative evaluation indicated that lime coagulation was the most economical method. Powdered carbon and column tests were performed to evaluate carbon adsorption treatment. Design criteria necessary for plant design are discussed and include flow, preliminary treatment, chemical feed, rapid mix, and flocculation, clarifier sizing, recarbonation, filtration, granular carbon adsorption, and carbon regeneration. Five alternative systems utilizing physical-chemical treatment of waste water are reviewed. Ten major installations utilizing physical-chemical treatment of raw waste water are listed. (See also W80-00097) (Lisk-FRC)
W80-00104

SYNTHESIS OF CATIONIC POLYELECTROLYTES FOR TREATMENT OF NATURAL AND WASTE WATERS,
V. V. Korshak, L. B. Zubakova, and L. B. Gandurina.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 76-80, 1975. 2 fig, 6 tab, 3 ref.

Descriptors: *Polymers, *Polyelectrolytes, *Cations, *Salts, *Flocculation, Waste water treatment, Acids, Organic compounds, Oil wastes, Industrial wastes.

The synthesis of cationic polyelectrolytes by polymer similar transformation of polymerization and polycondensation linear polymers or polymerization of nonlimitive ionogenous monomers is reviewed. Quaternary vinylpyridine salts (QVPS) on vinylpyridine are used for the synthesis of highly basic water soluble polyelectrolytes. The polymerization of vinylpyridine salts was performed by spontaneous QVPS polymerization in concentrated water solutions by specific ion mechanisms, by radical QVPS polymerization in water ethanol solutions, or by radical QVPS polymerization without their intermediate isolation. The electroconductivity of water solutions of QVPS and polyelectrolytes (HPS-flocculants) at their base concentration of 0.015 mole/liter were compared. Cationic polyelectrolytes based on vinylpyridines were considered suitable for industrial waste water treatment but highly molecular polyvinylpyridine salts obtained by spontaneous polymerization of QVPS were the most effective flocculants. The utilization of HPS-II flocculant with a molecular weight of 700,000 treats waste waters containing acid dyes, petroleum products, dissolved and emulsified organic substances with an efficiency of 95-100%. (See also W80-00097) (Lisk-FRC)
W80-00105

PHYSICAL-CHEMICAL TREATMENT OF WASTEWATERS FROM THE PETROLEUM REFINING-PETROCHEMICAL INDUSTRY,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
W. J. Lacy, and A. Cywin.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 81-89, 1975. 1 fig, 9 tab, 24 ref.

Descriptors: *Oil industry, *Oil wastes, *Oily water, *Research and development, *Grants, Pollutant identification, Biochemical oxygen demand, Chemical oxygen demand, Waste water treatment, Industrial wastes.

The characteristics of waste waters from the petroleum refining and petrochemical industries are examined prior to a review of current treatment technology and research and demonstration grant programs. Ideal industrial waste treatment processes should effectively remove pollutants at a minimum cost, economically recover by-products, recycle recovered products and water to the process operation, require simple and minimum operating labor, and require low capital cost. Waste waters typically contain an average of 1,150 mg/liter BOD and 3,100 mg/liter COD. Oil refinery treatment processes include API separator, clarifier, dissolved air, flotation, filter, oxidation pond, aerated lagoon, activated sludge, trickling filter, cooling tower, activated carbon, granular media, and activated carbon processes. The efficiencies of these processes for removing BOD, COD, total organic carbon, suspended solids, oil, phenol, ammonia, and sulfide are provided. The need for research, development, and demonstration of biological oxidation, sludge disposal, advanced treatment, closed loop systems, and comprehensive approaches to treatment of waste waters is reviewed. Organizations having grants for the research and development of pollution control in the petroleum refining and petrochemical industry are cited. (See also W80-00097) (Lisk-FRC)
W80-00106

EXAMINATION OF OIL-CONTAINING WASTE WATERS CHEMICAL COMPOSITION AFTER THEIR TREATMENT IN AERATION TANKS,
For primary bibliographic entry see Field 5A.
W80-00107

COMPARISON OF ALTERNATIVE STRATEGIES FOR COKE PLANT WASTEWATER DISPOSAL,
R. W. Dunlap, and F. C. McMichael.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 96-104. 1975. 7 fig, 7 tab, 7 ref.

Descriptors: *Ammonia, *Phenols, *Cooling water, *Biological treatment, *Chemical reactions, Separation techniques, Recycling, Quenching, Water reuse, Waste water treatment, Industrial wastes.

Waste waters from coke plants are generated from tar still waste water, excess or waste ammonia liquor (WAL) from the primary cooler, ammonia absorber and crystallizer blowdown, final cooler waste water blowdown, light oil plant waste water, and gas desulfurization and cyanide stripper waste water. The practice of quenching with coke plant effluents rather than discharging them was recommended, regardless of the level of treatment. Tight rather than loose recycle of cooling waters was preferred. Level I treatment consists of physical-chemical systems of cyanide stripping, ammonia removal with a conventional still, and phenol extraction. Level II combines physical-chemical treatment with biological waste treatment. For recycling of cooling waters for quenching, no treatment is preferred, while Level I is preferred when waste waters are discharged. (See also W80-00097) (Lisk-FRC)
W80-00108

STUDIES ON OXIDATION PROCESSES OF CYANIDES AND PHENOLS IN WASTE AND NATURAL WATERS BY USING CHLORINE DIOXIDE,
A. N. Belevtzev, and Ju. L. Maximenko.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 105-110, 1975. 9 fig.

Descriptors: *Phenols, *Chlorine dioxide, *Oxidation, *Oil industry, *Organic compounds, Chemical oxygen demand, Chemical reactions, Oil wastes, Waste water treatment, Industrial wastes.

The use of chlorine dioxide as an alternative to hypochlorite, chlorine, and chloride of lime in the treatment of cyanides and phenols in industrial waste and natural waters was examined. Chlorine dioxide was evaluated over other oxidizing agents because of its relative stability in water solutions and its high oxidation potential. Tests were performed for the oxidation of simple and complex cyanides, rhodonides, sulfides, and phenols. The chemical reactions occurring during the oxidation of phenols and cyanides by chlorine dioxide are reviewed, and the effects of pH, temperature, and pollutant concentration on the oxidation process are presented. COD was reduced by 90-95% with a chlorine dioxide dose of 5-8 mg/l mg of COD removed. Phenols in the concentration range of 0.1-1 mg/liter in biochemically treated refinery effluents were effectively oxidized with a chlorine dioxide dose of 5 mg/liter over a 10-15 min period. (See also W80-00097) (Lisk-FRC)
W80-00109

TREATMENT OF CONCENTRATED WASTE WATERS CONTAINING OIL EMULSIONS,
V. G. Ponomarev, and S. B. Zakharina.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 120-123, 1975. 3 fig.

Descriptors: *Oily water, *Emulsions, *Separation techniques, *Settling basins, *Filtration, Sludge treatment, Flotation, Suspended solids, Waste water treatment, Industrial wastes.

A system of treating and regenerating waste waters containing oil emulsions is presented. From bench-scale and industrial tests, the treatment system incorporates settling to separate oil and suspended solids, filtration, treatment in a settling-reacting tank where hydrogen sulfide odors are treated with KMnO4, sodium nitrate, and hexachlorophene, passage of suspended materials to a sludge holding tank and oil to an oil collector, and feeding of the sludge to filter presses for dehydration. Pressure flotation with the application of aluminum sulfate, ferrous sulfate, ferrous chloride, or sulfuric acid was also evaluated. Centrifugation and hyperfiltration were also investigated. (See also W80-00097) (Lisk-FRC)
W80-00111

ADVANCED WASTEWATER TREATMENT FOR AN ORGANIC CHEMICALS MANUFACTURING COMPLEX,
A. C. Marek, and W. Askins.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 124-135, 1975. 10 fig, 7 tab.

Descriptors: *Chemical wastes, *Chemical industry, *Activated carbon, *Filtration, *Dyes, Pilot plants, Laboratory tests, Coals, Sands, Adsorption, Waste water treatment, Tertiary treatment, Industrial wastes.

The waste water treatment system for effluents from the American Cyanamid Company, a manufacturer of dyes, chemical intermediates, organic pigments, plastic additives, pharmaceuticals, fine chemicals, agricultural chemicals, elastomers, and rubber chemicals is reviewed. An advanced waste water treat is under design for treating the effluent which already receives primary and secondary treatment. Research and laboratory bench scale studies of various treatment processes indicated that trimedia filtration and carbon adsorption was the preferred treatment system. The trimedia filter contained layers of coal, sand, and garnet. Pilot plant studies and prototype systems were operated to test the processes and a full-scale system is under design from the results. (See also W80-00097) (Lisk-FRC)
W80-00112

COST BENEFITS OF PHYSICAL CHEMICAL TREATMENT,
F. P. Sebastian.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 136-143, 1975. 5 fig, 5 tab, 11 ref.

Descriptors: Treatment facilities, *Cost-benefit analysis, *Economics, *Polychlorinated biphenyls, *Pesticides, Biological treatment, Chemical reactions, Waste water treatment, Municipal wastes.

The suitability and cost benefits of utilizing independent physical chemical treatment (IPCT) systems for treating waste waters were examined. IPCT systems are considered economically competitive with biological treatment systems for complying with the 1977 mandate for best practicable control technology. These systems may also be more economically upgraded to the 1983 standard of best available technology than the addition of tertiary treatment to biological plants. IPCT systems effectively control polychlorinated biphenyls, pesticides, and heavy metals and produces ash product-fertilizer. Energy may be reclaimed from the sludge and particulate emissions meet EPA air pollution standards. (See also W80-00097) (Lisk-FRC)
W80-00113

PROCESSING AND NEUTRALIZATION OF INDUSTRIAL WASTES FROM IRON AND STEEL EFFLUENTS TREATMENT,
O. P. Ostrovsky, U. M. Souproun, and U. N. Reznikov.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975, p 144-149, 1975. 2 tab.

Descriptors: *Sludge treatment, *Steel, *Iron, *Dewatering, *Neutralization, Burning, Minerals, Filtration, Centrifugation, Desalination processes, Waste treatment, Waste water treatment, Industrial wastes.

The treatment and utilization of sludges from iron and steel processing plants are reviewed. Iron-bearing and gypsum-bearing sludges comprise the larger portion of the wastes from these plants. Sludges are produced from sintering plants, stock houses of blast furnace shops, gas cleaning installations of blast furnaces, converter, open hearth furnaces, and electric melting furnaces, mill scale, desulfuration, neutralized sulfuric acid wastes, and other sources. High-mineralized waste waters and organic wastes are also generated. Certain sludges are utilized for other purposes and processes and dewatering units include classifiers, vacuum filters, press filters, and centrifuges. The three basic process flow diagrams are for multisized sludge dewatering, for dewatering of monodispersed sludge of intermediate size, and for highly dispersed sludge dewatering. High mineralized wastes are dewatered with thermal desalting and organic wastes are neutralized with a flame method using cyclone furnaces. (See also W80-00097) (Lisk-FRC)
W80-00114

FUNDAMENTAL PRINCIPLES OF SELECTING THE METHOD FOR PROCESSING SEWAGE SEDIMENTS IN ACCORDANCE WITH THEIR PROPERTIES,
N. A. Lukinykh, and I. S. Turovsky.
In: 2nd USA/USSR Symposium on Physical/Chemical Treatment from Municipal and Industrial Sources, Cincinnati, Ohio, November 12-14, 1975. p 150-153, 1975. 3 fig, 4 ref.

Descriptors: *Sewage sludge, *Dewatering, *Sludge treatment, *Mathematical models, *Analytical techniques, Filters, Centrifugation, Biological treatment, Waste water treatment, Municipal wastes.

Methods of treating sediments resulting from the treatment of sewage include fermentation in anaerobic and aerobic conditions, drying on silt pads and ponds, dehydration on vacuum filters, centrifuges, filter presses, and other devices, and decontamination by thermal treatment or incineration. The specific resistance of the filtration sediment, the centrifuging index, and the position of the first critical humidity point were found to control the characteristics of sewage sediment dewatering. Methods were developed for determining the appropriate sediment treatment method and the degree of readiness of the sediment for mechanical dewatering. Gas suspension counter-currents combined with an air fountain regime was found to be the most efficient method of thermal drying of dewatered sewage sediments. (See also W80-00097) (Lisk-FRC)
W80-00115

PROCEEDINGS OF THE 8TH NATIONAL SYMPOSIUM ON FOOD PROCESSING WASTES, MARCH 30-APRIL 1, 1977, SEATTLE, WASHINGTON.
Report EPA-600/2-77-184, August 1977, 442 p.

Descriptors: *Food processing industry, *Waste treatment, *Industrial wastes, Byproducts, Water reuse.

Twenty-eight papers were presented on various topics dealing with the treatment or elimination of food processing wastes. The following topics are included: processing modifications, product and byproduct recovery, waste water treatment, water recycle, and water reuse for several segments of the food processing industry. Industry segments include red meat and poultry, seafood, dairy, fruit, and vegetable. About 200 representatives of industry, universities, consulting firms, and government attended the two day symposium. (See W80-00117 thru W80-00144) (Small-FRC)
W80-00116

STATUS OF EPA'S EFFLUENT GUIDELINES FOR THE FOOD INDUSTRY,
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
For primary bibliographic entry see Field 6E.
W80-00117

EFFLUENT POLISHING AND WASTEWATER REUSE AT SNOKIST GROWERS CANNERY,
Esvelt Environmental Engineering, Spokane, WA.
L. A. Esvelt, and H. H. Hart.
In: Proceedings of 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 20-37. 1977. 6 fig, 5 tab, 3 ref.

Descriptors: *Food processing industry, *Water reuse, *Activated sludge, *Filtration, *Chlorination, Recycling, Waste water treatment, Industrial water.

The feasibility of fruit wastewater reuse was investigated including documentation of the reduction of pollutants being discharged resulting from the reuse of process waters and the economics involved. Facilities for biological effluent polishing were installed and monitored. The reclaimed water was used for equipment cleaning, product cleaning, steam production, and cooling. The polishing system consists of mixed media filtration and chlorination, and the biological treatment system is an activated sludge type. The reclaimed water was of consistent quality for use in the areas investigated. The reuse of water during the 1976 process season resulted in approximately 35% reduction in waste water discharged. Projections for full scale cooling use indicate an effluent reduction of 50% or greater. (See also W80-00116) (Small-FRC)
W80-00118

CONTROL OF ODORS FROM AN ANAEROBIC LAGOON TREATING MEAT PACKING WASTES,
Texas Amarillo Systems Co.
J. A. Chittenden, L. E. Orsi, J. L. Witherow, and W. J. Wells.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977. Seattle, Washington, p 38-61, 1977. 6 fig, 12 tab, 15 ref.

Descriptors: *Hydrogen sulfide, *Odor, *Anaerobic digestion, *Food processing wastes, *Membranes, Chlorination, Costs, Incineration.

The control of hydrogen sulfide emissions from anaerobic lagoons treating meat packing wastes is reviewed. Lagoons which treat waste water containing 100 mg/liter or more of sulfate require odor control. Odor emissions can be reduced by designing submerged inlets and outlets, operations to maintain a complete scum cover, chlorination of the raw waste water prior to transport by pipeline, and changing to a water supply with lower sulfate levels. A flexible membrane cover and positive gas removal system can also control odor emissions. Even with the added cost of control equipment, anaerobic lagoons are less expensive than aerobic treatment for meat packing wastes. The odorous gas can be incinerated or used in a dedicated boiler for the production of steam. (See also W80-00116) (Small-FRC)
W80-00119

TOMATO CLEANING, WATER RECYCLE AND MUD DEWATERING,
National Canners Association, Berkeley, CA.
W. W. Rose.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 62-75, 1977, 2 fig, 4 tab, 5 ref.

Descriptors: *Food processing industry, *Dewatering, *Industrial water, *Mud, *Industrial wastes, Performance, Costs, Tomatoes, Waste water treatment, Water reuse.

The problem of cleaning mechanically harvested tomatoes with less water, the removal of mud from the dump tank, and the development of a water recycle system, were investigated. Mechanical energy in the form of rotating rubber discs used a minimum of water and cleaned the tomatoes adequately. Physical and chemical treatment was applied to the dump tank water and the water was recycled back to the dump tank. Dewatering of mud by a horizontal vacuum belt was investigated. The dewatering system consisted of: a sludge receiving hopper, a vacuum belt with variable speed chain drive, a vacuum source and filtrate withdrawal pump, and filter cake removal and belt cleaning units. Dewatering efficiency was between 17 and 70% with an average of 37%. The drying factor ranged from 1.21 to 1.89 with an average of 1.53. Sludge volume reduction efficiencies ranged from 17 to 49%, and solids recovery efficiencies ranged from 91 to 99%. The dewatering unit cost $2 per ton of dry solids. (See also W80-00116) (Small-FRC)
W80-00120

REMOVAL OF SUSPENDED SOLIDS AND ALGAE FROM AEROBIC LAGOON EFFLUENT TO MEET PROPOSED 1983 DISCHARGE STANDARDS TO STREAMS,
Swift and Co., Oak Brook, IL.
E. R. Ramirez, D. L. Johnson, and T. E. Elliott.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 76-84, 1977. 5 fig, 4 tab, 10 ref.

Descriptors: *Algae control, *Coagulation, *Costs, *Food processing wastes, *Suspended solids, Standards, Regulation, Aerobic conditions, Waste water treatment.

A process which combines electrocoagulation with a specially designed dissolved air flotation basin was developed for the removal of suspended solids and algae from aerobic lagoon effluent. The process was developed to meet the needs of a hog packing plant which processes about 2000 hogs per day. The plant was experiencing difficulty in meeting effluent standards due to the growth of algae in aerobic lagoons. A Lectroclear system was installed which can meet both 1977 and 1983 effluent standards by increasing the amount of metal coagulant employed. The system first destabilizes the hydrophilic biocolloid and recycle dissolved air flotation removes the last traces of suspended material from the waste water. Annual operating and maintenance costs based on a design of 1500 gallons per minute was an estimated maximum of $75,000 per year. Annual fixed costs and depreciation costs were estimated at $25,000. (See also W80-00116) (Small-FRC)
W80-00121

EFFLUENT GENERATION, ENERGY USE AND COST OF BLANCHING,
Science and Education Administration, Albany, CA. Western Regional Research Center.
J. L. Bomben.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 85-97, 1977. 2 fig, 9 tab, 12 ref.

Descriptors: *Food processing wastes, *Industrial water, *Cost, *Vegetable crops, Industrial wastes, Efficiencies, Mechanical equipment.

The characteristics of conventional blanchers and new blancher designs, and the effluent generation and energy use of blanchers are discussed. Also, the cost of blanching with four different blanchers was investigated. Water blanching had the highest hydraulic waste load, but because of its low capital investment it costs significantly less than other blanching methods. The Vibratory Spiral Blancher had a higher steam efficiency than other blanchers, and when combined with a Vibratory Spiral Cooler, it generated less wastewater than the other techniques with the exception of Hot-gas Blanching. The hydrostatic steam blancher had a much higher steam efficiency than conventional steam blanchers, but its efficiency was less than that of the Vibratory Spiral Blancher or a water blancher. Because frozen vegetables are sold by weight, yield loss from air cooling is a significant economic penalty. (See also W80-00116) (Small-FRC)
W80-00122

DISSOLVED AIR FLOTATION TREATMENT OF SEAFOOD PROCESSING WASTES - AN ASSESSMENT,

Jordan (Edward C.), Inc., Portland, ME.
D. B. Ertz, J. S. Atwell, and E. H. Forsht.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 98-118, 1977. 3 fig, 14 tab, 10 ref.

Descriptors: *Food processing industry, *Flotation, *Industrial water, Design criteria, Suspended solids, Dewatering, Waste disposal, Optimization.

The dissolved air flotation method is being used by large tuna canners in San Diego, Puerto Rico, American Samoa, and Terminal Island for the treatment of seafood processing waste waters. Facilities were monitored and found to generally meet design criteria for overflow rate, solids loadings, air to solids ratio, hydraulic retention time, and the ability to maintain the appropriate pH level. Optimum criteria are: overflow rate 2 gpm/sq ft, solids loading 1 lb/hour/sq ft, air to solids ratio 0.01-0.04, and hydraulic retention time of 1 hour. The handling and disposal of residuals is a problem. One tuna processor dewaters the residuals by centrifugation, but by-product recovery has not been implemented on a full scale. (See also W80-00116) (Small-FRC)
W80-00123

COMMERCIAL FEASIBILITY OF RECOVERING TOMATO PEELING RESIDUALS,
Science and Education Administration, Albany, CA. Western Regional Research Center.
W. G. Schultz, H. J. Neumann, J. E. Schade, J. P. Morgan, and P. F. Hanni.
In: Proceedings of 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 119-136, 1977. 3 fig, 2 tab, 22 ref.

Descriptors: *Food processing industry, *Industrial wastes, *Byproducts, *Acidic water, Waste water treatment, Industrial water, Separation techniques, Water pollution sources.

A two year project to investigate the feasibility of recovering tomato peeling residues for food use is described. During the first year, peel was processed through a 20 gpm continuous flow line which consisted of acidifying the peel to pH 4.2 with food-grade hydrochloric acid, then separating the pulp from the skin with a paddle finisher. The recovered pulp was of food quality but contained large amounts of peeling-aid residues. Peeling aids are approved for peeling but not as additives to the final product. During the second year modifications of the peeling process were studied. The tomatoes were pretreated by immersion in a 150 F aqueous bath containing about 0.15% food-grade octanoic acid. Recovered pulp met USDA quality Grade A, and the octanoic acid levels were generally low (30 ppm). (See also W80-00116) (Small-FRC)
W80-00124

APPLICATION OF FINE SCREENS IN THE TREATMENT OF FOOD PROCESSING WASTEWATER,
C-E Bauer, Springfield, OH.
R. Neal, R. Chaney, and A. Bubp.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 147-154, 1977. 1 fig, 2 tab.

Descriptors: *Screens, *Suspended solids, *Food processing industry, *Waste water treatment, *Economics, Maintenance, Performance, Byproducts.

Fine screens are the most common pretreatment device in the food processing industry for process waste waters. The static fine screen is described which is widely used for solids removal because of its effectiveness, simplicity, and economy. It is particularly useful for applications where minimum maintenance is required. The use of fine screens is reviewed for the following industries: vegetable and food processing, meat packing, dairy, poultry growing and processing, seafood processing, and brewery, distillery, and wine. Rapid return on investment has been experienced by many food processors after the installation of static screens due to reduced sewer surcharges or byproduct recovery. (See also W80-00116) (Small-FRC)
W80-00126

REUSE OF BRINES IN COMMERCIAL CUCUMBER FERMENTATIONS,
Michigan State Univ., East Lansing. Dept. of Food Science and Human Nutrition.
R. F. McFeeters, M. P. Palnikar, M. Velting, N. Fehringer, and W. Coon.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 169-185, 1977. 1 fig, 16 tab, 8 ref.

Descriptors: *Food processing industry, *Fermentation, *Vegetable crops, *Water reuse, *Brines, Recycling, Industrial water, Disinfection, Economics, Performance.

Recycling procedures for cucumber fermentation brines were investigated as means of minimizing the waste water produced. Chemical and pasturization procedures were compared as methods of eliminating pectinase activity in the recycled brine. The use of fermentation brines for three cycles showed no differences between fermentations in recycled brines and those carried out in control brines. Differences were observed in pH, titratable acidity, and time of fermentation. The two treatment methods were equally successful. Pasturization allows about 95% recovery of brine. Chemical treatment results in a somewhat higher loss of brine, but a recovery of 90% is feasible. Chemical treatment did degrade pesticide residues while pasturization did not. A small net savings is realized with pasturization. (See also W80-00116) (Small-FRC)
W80-00128

TREATMENT OF PACKINGHOUSE WASTEWATER BY SAND FILTRATION,
East Central Oklahoma State Univ., Ada. School of Environmental Science.
M. L. Rowe.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 186-196, 1977. 1 fig, 4 tab, 10 ref.

Descriptors: *Food processing industry, *Filtration, *Pilot plants, *Performance, *Costs, Maintenance, Operations, Biochemical oxygen demand, Coliforms, Treatment facilities, Regulation.

The treatment of meatpacking waste water by intermittent sand filtration was evaluated at the W. E. Reeves Packing Company in Ada, Oklahoma. Initially, two pilot scale units were used. Construction and operation of the sand filters are described. During early stages of operation the facility required a great deal of manpower for frequent filter unit cleanings. After filter media and hydraulic loading rates were modified, maintenance and operational problems became minimal. The facility's effluent met the 1977 effluent guidelines for all parameters with the exception of fecal coliforms. With the addition of a disinfection system, the facility could meet all guidelines. The 30-day average and maximum day average values for the 1983 limitations with respect to BOD-5 and the 30-day average value for suspended solids were exceeded slightly. The costs were estimated as follows: $2000 for sewer and manholes, $12,000 for extended aeration lagoon, $13,000 for sand filter, and $500 for annual maintenance of filter. (See also W80-00116) (Small-FRC)
W80-00129

AN EFFECTIVE WASTEWATER MANAGEMENT PROGRAM FOR A FOOD PROCESSOR,
Eutek, Inc., Sacramento, CA.
G. E. Wilson, and J. Y. C. Huang.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 200-210, 1977. 1 fig, 4 tab.

Descriptors: *Food processing industry, *Carrots, *Recycling, *Suspended solids, *Pilot plants, Waste water treatment, Turbidity, Flocculation, Filtration, Biochemical oxygen demand, Industrial wastes.

A carrot processor, a direct discharger, installed a process waste water recycle and final effluent polishing system which meets the requirements of the National Pollutant Discharge Elimination System. First, soil solids removal and waste reuse systems were evaluated. A pilot system for suspended and colloidal solids was implemented which included: a chemical feeding pump and diffuser, decayed gradient flocculator, gravity sedimentation tank, and granular media filter. The full scale system utilized a decayed gradient flocculator/gravity clarifier and coarse media contact filtration. The turbidity, suspended solids, biochemical oxygen demand, and chemical oxygen demand of the treated water were 7-20 FTU, 10 to 30 mg/liter, 5 to 10 mg/liter, and 25 to 50 mg/liter, respectively. The discharge meets all requirements and is suitable for reuse. (See also W80-00116) (Small-FRC)
W80-00130

ECONOMIC RETURN ON POLLUTION CONTROL EXPENDITURES FOR THE PICKLED FOOD INDUSTRY,
Johnson and Anderson, Inc., Pontiac, MI.
J. G. Meeahan.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 197-199, 1977.

Descriptors: *Food processing industry, *Chlorides, *Filtration, *Operation and maintenance, Industrial wastes, Pollution abatement, Waste water, Operations.

Approximately 35% of the water usage at plants which ferment, store, and pack pickled food could be reduced, and raw waste loading could be reduced through improved housekeeping and screening. Chlorides can also be reduced through elimination of tank leakage and control of storm water runoff. In the cucumber pickling industry, chloride reductions can be realized by: proper pumping of cucumbers and pickles, degassification and recirculation of fermentation brine, and adjustment of fermentation brine constitutents. Cost reduction features which also control pollution are: clustering of tanks, permenantly sealed tank tops, slicing of cucumbers and pickles to eliminate damaged stock, controlled fermentation, reuse of brine, and the elimination of forklift trucks, tote boxes, etc. (See also W80-00116) (Small-FRC)
W80-00131

RECOVERY OF SOLUBLE SERUM PROTEINS FROM MEAT INDUSTRY WASTES,
Washington State Dept. of Ecology, Olympia.
R. W. Greiling.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 211-234, 1977. 8 fig, 5 tab, 8 ref.

Descriptors: *Food processing industry, *Industrial wastes, *Proteins, *Byproducts, Hydrogen ion concentration, Coagulation, Performance, Economics, Waste water treatment.

Laboratory investigations of methods for the recovery of soluble serum proteins from slaughterhouse wastes determined that dissolved serum proteins can be recovered economically through pH and temperature denaturation. An effective coagulant aid is the organic polymer chitosin. Dissolved proteins are removed most effectively when pH is at or below the isoelectric point. Also, a minimum operating temperature of 60 degrees C should be maintained for maximum recovery. Protein removal efficiency can be measured by organic nitrogen and is predicted by a six parameter model. The estimated net worth of the dried protein product plus cost savings from current treatment systems should be more than sufficient to amortize the required capital investment and cover preliminary cost estimates. (See also W80-00116) (Small-FRC)
W80-00132

IMPROVED BIOLOGICAL TREATMENT OF FOOD PROCESSING WASTES WITH TWO-STAGE ABF PROCESS,
Neptune Microfloc, Inc., Corvallis, OR.
B. W. Hemphill, and R. G. Dunnahoe.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 235-252, 1977. 7 fig, 5 tab, 10 ref.

Descriptors: *Filtration, *Food processing industry, *Biological treatment, *Microorganisms, Aeration, Performance, Waste water treatment, Industrial wastes.

Data from pilot scale studies and full scale plants using the activated bio-filtration (ABF) process for the treatment of food processing wastes, are presented and discussed. The process combines the advantages of both the fixed-film and suspended growth treatment systems and has a superior process stability. After primary treatment, the waste water is combined with sludge from the secondary clarifier and Bio-Cell recycle and pumped to the Bio-Cell. Fixed-film organisms attach to horizontal bio-media, and suspended growth organisms combine with the fixed-film to oxidize biodegradable organics. An aeration basin is usually employed. System design criteria are expressed in terms of Bio-Cell organic loadings and aeration basin loadings are expressed as System F/M. The energy-efficient fixed-film Bio-Cell realizes significant power savings. (See also W80-00116) (Small-FRC)
W80-00133

SINGLE CELL PROTEIN FROM FOOD WASTES BY THE DEEP TANK PROCESS,
Idaho Univ., Moscow. Dept. of Chemical Engineering.
M. L. Jackson, and C. C. Shen.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 253-265, 1977. 6 tab, 19 ref.

Descriptors: *Food processing industry, *Industrial wastes, *Byproducts, *Proteins, *Potatoes, Aeration, Flotation, Costs.

The procedures for the production of single cell protein from food processing wastes using deep tank aeration-flotation for fermentation processing are reviewed. An economic estimate of the continuous conversion of 1.25 million gal/day of a potato waste and the sale of the single cell protein for animal feed, indicates that the income should almost double the production costs. The economics of producing single cell protein by batch processing indicates that tankage costs would be 2 to 3 times more than that for continuous flow. Also, capital costs would increase from 30 to 40%, while operating costs would remain unchanged. (See also W80-00116) (Small-FRC)
W80-00134

EVALUATION OF INSTANT NOODLES PROCESSING WASTEWATER CHARACTERISTICS AND TREATMENT ALTERNATIVES,
Hawaii Univ. at Manoa, Honolulu.
P. Y. Yang, and V. S. Luis.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 266-283, 1977. 12 fig, 2 tab, 2 ref.

Descriptors: *Food processing industry, *Industrial wastes, *Biological treatment, *Coagulation, Activated sludge, Aeration, Biochemical oxygen demand, Suspended solids.

Waste water characteristics and treatment alternatives were evaluated for an instant noodle processing plant producing waste water containing soap, grease, flour, and noodle strands. Treatment methods considered were: sedimentation/flotation, coagulation, and biological treatment. For optimum results, grease should be removed first, and a semi-continuous flow plant should be used. Sedimentation even with chemical coagulation is not recommended. Biological treatment is necessary because of the high BOD-5, COD, and volatile solids. The extended aeration activated sludge process with prior grease removal is recommended. (See also W80-00116) (Small-FRC)
W80-00135

POTATO JUICE PROCESSING,
Massachusetts Univ., Amherst. Dept. of Food and Agricultural Engineering.
J. R. Rosenau, L. F. Whitney, and J. R. Haight.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 284-291, 1977. 2 fig, 14 ref.

Descriptors: *Byproducts, *Protein, *Food processing industry, *Potatoes, Waste treatment, Reverse osmosis, Costs, Drying.

A method for the production of animal feeds by potato juice processing is reviewed. Juice is heated quickly and centrifuged. The resulting protein sludge is about 20% solids and 70% crude protein. The sludge is spray dried as high protein meal. The remaining juice is concentrated to 15% solids by reverse osmosis followed by evaporation to 70% solids. These solids are thin mixed with the pulp and dried. When an average of 400 ton of potatoes are processed each day by a staff of ten, the plant costs about $2,000,000. There is about a 42% return on the investment. (See also W80-00116) (Small-FRC)
W80-00136

RECOVERY AND APPLICATION OF ORGANIC WASTES FROM THE LOUISIANA SHRIMP CANNING INDUSTRY,
Louisiana State Univ., Baton Rouge. Dept. of Food Science.
B. E. Perkins, and S. P. Meyers.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 292-307, 1977. 5 fig, 5 tab, 13 ref.

Descriptors: *Food processing industry, *Industrial wastes, *Shrimp, *Byproducts, *Waste treatment, Proteins, Filtration, Carbon, Feeds.

Methods for the recovery and application of organic wastes from the Louisiana shrimp canning industry are reviewed. Wastes from Gulf canned and frozen shrimp amounted to 179.5 million lbs in 1976. Shrimp blanch water and raw shrimp processing water were analyzed. Screening of blanch water followed by chemical removal of dissolved protein and sugar resulted in a acceptable reduction in total carbon. Shrimp byproducts can be used in livestock feed, tropical fish/bird diets, aquaculture diets, pet food, and in fabricated shrimp products. (See also W80-00116) (Small-FRC)
W80-00137

TOXICITY OF SOME CANADIAN FRUIT AND VEGETABLE PROCESSING EFFLUENTS,
Stanley Associates Engineering Ltd., Edmonton (Alberta).
A. Lamb, C. W. Fulton, and P. Mulyk.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 308-321, 1977. 1 fig, 5 tab.

Descriptors: *Toxicity, *Food processing industry, *Industrial water, *Bioassay, *Sweet corn, Fish, Biochemical oxygen demand, Suspended solids, Nitrogen, Waste water treatment.

Waste water toxicity in the fruit and vegetable processing industry is reviewed for 221 Canadian plants. Total potential raw waste water BOD-5 varies from 0.82 times 10 to the 6th power to 12.02 times 10 to the 6th power kg and suspended solids varies from 0.30 times 10 to the 6th power to 2.99 times 10 to the 6th power kg. Existing treatment systems remove 76.2% of total BOD-5 and 79.8% of total suspended solids. Bioassay tests involving operations of fish mortality determined that raw screened waste waters from tomato, corn, beet, apple, plum, broccoli, and jam processing operations were toxic. Treated effluent from corn processing was toxic while other treated effluents demonstrated no toxicity. The high organic nitrogen content of corn processing effluents may contribute to toxicity. (See also W80-00116) (Small-FRC)
W80-00138

REDUCTION OF WASTES FROM CUCUMBER PICKLE PROCESSING BY USE OF THE CONTROLLED CULTURE FERMENTATION PROCESS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
L. W. Little, R. Harrison, J. Davis, J. Harris, and S. J. Dunn.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 322-332, 1977. 3 fig, 2 tab, 6 ref.

Descriptors: *Food processing industry, *Fermentation, *Industrial wastes, *Brines, *Salts, Industrial water.

A commercial demonstration project using the controlled culture fermentation procedure (CCF) was evaluated for waste reduction in the cucumber pickling industry. Using this procedure, cucumbers are sanitized by a chlorine wash and the brine is inoculated with rapid-growing lactic acid bacteria. CCF fermentations are more rapid and result in higher levels of acidity than do natural fermentations. A brinestock of superior quality is produced, and the amount of salt to be discharged is reduced. Whole dill pickles produced by CCF are equal in taste and superior in appearance and texture to naturally fermented dills. Hamburger chips from the two processes are similar. (See also W80-00116) (Small-FRC)
W80-00139

SALMON PROCESSING WASTEWATER TREATMENT,
Kramer, Chin, and Mayo, Inc., Seattle, WA.
P. A. Bissonnette, S. S. Lin, and P. B. Liao.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 333-354, 1977. 5 fig, 11 tab, 8 ref.

Descriptors: *Food processing industry, *Industrial wastes, *Aeration, *Salmon, Regulation, Performance, Treatment facilities, Regulation.

The extended aeration process of the Skokomish salmon processing plant was evaluated with respect to Environmental Protection Agency effluent limitation guidelines. Flow and pollutants generated per ton of fish processed for small salmon was greater than for large salmon. Unexpected flows resulted in long retention times and overaeration. Higher removal efficiencies for phosphorus during the processing of large fish resulted from longer retention times and overaeration which caused denitrification and phosphorus release in the aeration chamber. During plant shutdown, the addition of fish food maintained the performance of the treatment system. The plant produces effluent which meets EPA limits in terms of BOD, suspended solids, and grease/oil. (See also W80-00116) (Small-FRC)
W80-00140

FUNGAL CONVERSION OF CARBOHYDRATE WASTES TO ANIMAL FEED PROTEIN-VITAMIN SUPPLEMENTS,
Denver Univ., CO. Dept. of Biological Sciences.
B. D. Church, C. M. Widmer, and R. Espinosa.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 355-388, 1977. 10 fig, 7 tab, 32 ref.

Descriptors: *Sweet corn, *Food processing industry, *Biochemical oxygen demand, *Biological treatment, *Industrial wastes, Waste treatment, Fermentation, Feeds.

A process was developed for the fungal conversion of corn wet-milling wastes to an animal feed protein-vitamin supplement which also reduced the BOD-5 level of the processing plant's waste. The fermentor is not described. A 10-20% fungal inocu-

lum level, a low pH of 4.0 to 4.5, selection of a rapid growing fungal strain, and the innoculation-dilution start-up procedure were required for maintenance of a near pure culture processing. Under optimum fermentation, the contaminant level rarely exceeded 200 microorganisms per ml. During equipment malfunction, Geotrichium, Penicillium, Aspergillus, and Mucor caused problems. Animal feeding trials were successful. (See also W80-00116) (Small-FRC)
W80-00141

WATER REUSE OF WASTEWATER FROM A POULTRY PROCESSING PLANT,
Pittsburgh Univ., PA.
J. B. Andelman, and J. D. Clise.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 389-410, 1977. 1 fig, 9 tab, 10 ref.

Descriptors: *Water reuse, *Food processing industry, *Poultry, *Feasibility studies, Industrial water, Water quality, Aeration, Filtration, Flocculation, Chlorination, Standards.

A reclamation system was evaluated for poultry processing plant waste water with reference to technical and economic feasibility. The reclamation system consisted of aerated lagoons, followed by microstraining, flocculation and sedimentation, and filtration with two stages of chlorination. The renovated water was sampled extensively and neither samonellae or enterobacteriaceae were isolated. Also, drug residues and avian viruses were not present in the reclaimed water or in the chicken carcasses. Organic and inorganic water quality analyses were performed. The reclaimed water met Environmental Protection Agency potable water standards. (See also W80-00116) (Small-FRC)
W80-00142

WATER REUSE IN POULTRY PROCESSING: CASE STUDY IN EGYPT,
Alexandria Univ. (Egypt). Higher Inst. of Public Health.
A. Hamza, S. Saad, and J. Witherow.
In: Proceedings of the 8th National Conference on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 411-426, 1977. 7 fig, 6 tab, 10 ref.

Descriptors: *Poultry, *Food processing industry, *Water reuse, *Cooling water, Water quality, Industrial water, Water treatment.

Poultry and water characteristics during poultry processing were evaluated and potential sources of water for reuse were investigated. The processing included killing and bleeding, scalding and defeathering, eviseration, and washing and chilling. A sampling program determined that compressor cooling water was virtually clean and could be reused in the scalding and defeathering operations. Trace metal and bacterial levels in various process waters were determined. Bacterial contamination of scalding water was higher than that of washing or chilling waters. There was a direct relationship between bacterial counts in the water and on the carcasses. Continual renovation of the process water is needed to reduce grease and bacterial levels. (See also W80-00116) (Small-FRC)
W80-00143

THE TREATMENT AND DISPOSAL OF WASTEWATER FROM DAIRY PROCESSING PLANTS,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
J. A. Moore, and B. M. Buxton.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 427-442, 1977. 7 fig, 5 tab, 2 ref.

Descriptors: *Standards, *Dairy industry, *Stabilization, *Industrial wastes, Biochemical oxygen demand, Suspended solids, Aeration, Trickling filters, Oxidation lagoons.

The effect of water pollution standards on the cost of dairy products to the consumer was evaluated. The effluent of some typical processing plants and several common treatment systems were monitored including: a small transfer station with a package aeration plant, a transfer station with a trickling filter system, a small butter plant with two-stage lagoon treatment, and a large cheese and butter plant with two-stage aerated lagoon and chemical treatment. The butter plant using a two-cell stabilization pond exhibited highest treatment of COD and total solids. The package aeration plant showed the poorest performance. A stabilization pond and ridge furrow system performed well and required low management skills. (See also W80-00116) (Small-FRC)
W80-00144

ALGAL ASSAYS FOR AREAS RECEIVING OR PROGRAMMED TO RECEIVE SEWAGE EFFLUENT,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5A.
W80-00193

DEVELOPMENT OF MICROWAVE PLASMA DETOXIFICATION PROCESS FOR HAZARDOUS WASTES. PHASE 1,
Lockheed Palo Alto Research Labs., CA.
L. J. Bailin, and B. L. Hertzler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 526, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-030, 1977. 64 p, 23 fig, 5 tab, 13 ref, 3 append.

Descriptors: *Microwaves, *Degradation, *Organic compounds, *Pesticides, *Laboratory tests, Pilot plants, Toxicity, Design criteria.

Microwave decomposition of organic materials was applied to the detoxification/destruction of hazardous organic pesticides and wastes using the Lockheed laboratory-size system. The detoxification process was then expanded to a larger-scale, continuous system using commercially available hardware. In the laboratory phase of the investigation, Malathion liquid, liquid PCB's, phenylmercuric acetate solution, and methyl bromide gas were tested, and the mechanics of the detoxification process were postulated. The expanded scale system was used to detoxify Malathion liquid, liquid PCB's, phenylmercuric acetate solution, and Kepone in the form of a solid powder, an aqueous slurry, and a solvent solution. Throughput of the system was maximized at 450 to 3200 g/hour, a multiplication factor of approximately 500 times that of the laboratory-scale unit. Specific engineering tasks are outlined for the construction of a pilot-scale unit for further testing of the system at 20 lb/hour. (Small-FRC)
W80-00244

INFORMATION ABOUT HAZARDOUS WASTE MANAGEMENT FACILITIES,
Environmental Protection Agency, Washington, DC. Office of Solid Waste.
D. Farb, and S. D. Ward.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 881, Price codes: A07 in paper copy, A01 in microfiche. Report EPA/530/SW-145, 1975. 130 p, 1 tab.

Descriptors: *Waste disposal, *Landfills, *Water pollution sources, Data collections, Publications, Costs, Treatment facilities.

Information on 64 hazardous waste facilities is presented in the form of a standard resume. Telephone interviews and site visits were used to collect the information. This document provides guidance to hazardous waste generators who need assistance in proper landfill procedures. Facilities are listed by EPA region. A matrix of facilities vs. type of waste accepted is presented. Inclusion of a facility in the registry is based on the fact that EPA was aware of its existence; EPA does not endorse any of the facilities listed. The resumes include information on background, waste streams accepted and excluded, waste handling methods employed, economics, and source of the information presented. (Small-FRC)
W80-00245

BACHMAN TREATMENT FACILITY FOR EXCESSIVE STORM FLOW IN SANITARY SEWERS,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
H. W. Wolf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 128, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-128, 1977. 136 p, 32 fig, 39 tab, 3 ref, 1 append.

Descriptors: *Municipal wastes, *Storm water, *Urban runoff, *Treatment facilities, Sludge, Performance, Flocculation, Chlorination, Viruses, Waste water treatment.

The Bachman Treatment Facility which provides physical-chemical treatment to municipal waste water flows during periods of heavy precipitation, is described. Treatment includes the addition of waste sludge from a water purification plant, flocculation, sedimentation, tube settling, and chlorination. The effects of the addition of the waste sludges was investigated as laboratory studies indicated that better suspended solids removals and BOD-5 removals would result. Due to dry weather, artificially high flows were created using water from a nearby creek and potable water from a fire hydrant. Using artificial flows, no benefit was observed when waste sludges were added. On the few occassions that natural high flows occurred, some benefit was observed. Bacterial viruses were refractory to the combined chlorine residuals and contact time, and were good indicators of pollution from the facility. A desirable component of the facility is a grit removal process. There was no odor problem. (Small-FRC)
W80-00246

METHODS FOR SEPARATION OF SEDIMENT FROM STORM WATER AT CONSTRUCTION SITES,
Science and Education Administration, Minneapolis, MN. St. Anthony Falls Hydraulic Lab.
J. F. Ripken, J. M. Killen, and J. S. Gulliver.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 782, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-033, 1977. 91 p, 46 fig, 1 tab, 16 ref.

Descriptors: *Construction, *Runoff, *Soil erosion, *Water pollution sources, *Separation techniques, Sieves, Settling basins, Filtration, Water treatment, Reviews.

The nature and amount of solids that may be transported by runoff at construction sites are discussed, and control methods are reviewed and evaluated. Simple sieves are usually not effective under most treatment conditions. Microstrainers should be considered if the site effluent contains solids above 25 to 30 microns in size. If a settling basin is used, a high rate gravity tube will not materially improve the effluent quality of a properly designed basin, but it can reduce the size of the required basins. A hydrocyclone is useful for removing fines, and centrifuges can produce effluent of a good quality but their costs are high. Stationary filters are effective for fines but are not useful at high flow rates. Rotary vacuum filters provide excellent effluent but must be attended and are expensive. At present, electrophoresis is not practical, and the upflow rapid sand filter is suggested for future study. This study is based on a review of published and unpublished technical literature. (Small-FRC)
W80-00247

WATER REUSE IN A WET PROCESS HARDBOARD MANUFACTURING PLANT,
Superior Fiber Products, Inc., WI.
R. L. Coda.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB-286 607, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-78-150, 1978. 42 p, 21 fig, 4 tab, 3 ref.

Descriptors: *Industrial wastes, *Industrial water, *Recirculated water, Biochemical oxygen demand, Water pollution sources, Waste water treatment, Industrial production.

A project is described which was designed to eliminate any discharge of process water during the manufacture of smooth on one side, wet process hardboard. Before water reuse, the plant discharged about 757,000 liters/day of white water with a BOD-5 loading of 2710 Kg/day. After a system of complete white water reuse was installed, discharges of about 18,925 liters/day with a loading of about 340 Kg/day BOD-5 resulted. White water total solids concentration increased from 1% to about 7% with water reuse. Hardboard strength was equal to or better than the strength produced before the closed system was introduced. The closed system used less chemicals, both during the manufacturing process and during waste water treatment. Some disadvantages of the closed system are darker board color and overall reduced cleanliness of the mill. The highly concentrated white water leaves increased residue when spilled. The residual waste flow consisting of wash water and small amounts of white water leakage, will be reduced or eliminated in the future. (Small-FRC)
W80-00250

REUSE OF FERMENTATION BRINES IN THE CUCUMBER PICKLING INDUSTRY,
Michigan State Univ., East Lansing. Dept. of Food Science and Human Nutrition.
R. F. McFeeters, W. Coon, M. P. Palnitkar, M. Velting, and N. Fehringer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 585, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-78-207, 1978. 116 p, 5 fig, 79 tab, 35 ref, 1 append.

Descriptors: *Recycling, *Brines, *Food processing industry, *Feasibility studies, On-site investigations, Industrial water, Temperature, Hydrogen ion concentration, Costs.

The technology and economic feasibility of recycling cucumber brines was evaluated on a commercial scale. Studies were conducted to determine the performance of two brine treatments: heat treatment and chemical treatment. Heat treatment of 175 F for 30 seconds was sufficient to inactivate pectinases from molds found to be common on cucumber fruits and flowers. A brine temperature of 72 F or higher was necessary for effective chemical treatment. Also, pH had to be maintained at 11.0 or higher for at least 36 hours to ensure 99% pectinases inactivation. Using the recycling procedures, a small net savings was realized with the heat treatment method while a small net cost resulted with the chemical treatment. Brine can be reused at least three times on a commercial basis. There were no ill effects of recycling. (Small-FRC)
W80-00251

FIELD MANUAL FOR PERFORMANCE EVALUATION AND TROUBLESHOOTING AT MUNICIPAL WASTEWATER TREATMENT FACILITIES,
Culp/Wesner/Culp, El Dorado Hills, CA.
G. L. Culp, and N. F. Heim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 448, Price codes: A18 in paper copy, A01 in microfiche. Report EPA-430-9-78-001, 1978. 396 p, 105 fig, 42 fig, 6 ref.

Descriptors: *Treatment facilities, *Design criteria, *Evaluations, *Municipal wastes, Waste water treatment, Performance, On-site tests, Environmental engineering.

This manual is a technical field guide or reference document to be used in projects to improve the performance of municipal waste water treatment plants. It is a troubleshooting guide for identifying problems, analyzing problems, and solving problems. A step-by-step procedure is outlined for organizing information before a plant is visited for an on-site evaluation. Overall system considerations are presented. Unit processes are described and the effect of each process on other system processes is considered. Information is presented in safety, staffing, monitoring, emergency procedures, and maintenance considerations. Unit processes are also evaluated. Forty processes are described, and typical design criteria and performance evaluation are presented. Also, design shortcomings are discussed for each of the forty processes, and ways of overcoming these shortcomings are presented. (Small-FRC)
W80-00253

AIRCRAFT INDUSTRY WASTEWATER RECYCLING,
Boeing Commercial Airplane Co., Seattle, WA.
A. K. Robinson, and D. F. Sekits.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 210, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-78-130, 1978. 92 p, 14 fig, 11 tab, 8 ref, 8 append.

Descriptors: *Recycling, *Feasibility studies, *Costs, *Industrial water, Chemical wastes, Dyes, Industrial wastes, Waste water treatment.

The feasibility of recycling certain categories of water used during the manufacture of aircraft was investigated. Waters studied included chemical process rinse water, dye-penetrant crack-detection rinse water, machine shop coolant, and cyanide-containing rinse water. Water used only for cooling and sanitary water were not included. Three hundred liter treatment plants were used to continuously purify and then recontaminant water in a closed demonstration loop. The cost of a full-scale treatment plant was estimated. For an airplane factory generating 1.5 Ml/day the capital cost including installation was estimated at $3.4 million; and recycling costs of $0.94/kl for chemical process rinse water, $1.65/kl for dye-penetrant rinse water, $4.36/kl for cyanide rinse water, and $12.18/kl for machine shop coolant. (Small-FRC)
W80-00255

IMMOBILIZATION OF HAZARDOUS RESIDUALS BY ENCAPSULATION,
Washington State Univ., Pullman. Dept. of Materials Science and Engineering.
R. V. Subramanian, and R. Mahalingam.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 648, Price codes: A03 in paper copy, A01 in microfiche. Report NSF/RA-760361, 1976. 39 p, 8 fig, 5 tab, 4 ref, 1 append.

Descriptors: *Industrial wastes, *Waste disposal, *Polymers, *Laboratory tests, Water pollution sources, Leachate, Safety, Hazards.

Described is research progress made in an attempt to encapsulate hazardous wastes in a water-extensible polyester matrix to yield solidified products with rigid, light-weight shock proof structures. The wastes could then be safely stored, transported, and disposed of in landfills or burial grounds. Laboratory investigations were carried out, and some semi-continuous pilot studies were made. Immobilization of low-level radioactive wastes and some chemical wastes was achieved in three steps: preparation of a waste solution or slurry in an aqueous medium, continuous emulsification and encapsulation by the polymer resin, and solidification of the emulsion in small-volume cans. Uniform emulsions were formed and the quality of the encapsulation was excellent. (Small-FRC)
W80-00256

THE ECONOMIC IMPLICATIONS OF WATER RE-USE,
Environmental Control Consultancy Services Ltd., London (England).
D. Anderson, and R. H. Marks.
Chemsa, Vol. 3, No. 9, p 149-150, 1977. 2 tab.

Descriptors: *Reclaimed water, *Water reuse, *Costs, *Biological treatment, *Industrial water, Filtration, Chlorination, Activated carbon, Economics.

Some of the economic aspects of water reuse are explored and related to relevant technology. Economic design criteria are reviewed including total fixed investment, operating cost, and profit rates. An equation is presented for cost estimates. Water reuse technology is discussed briefly. An example is presented of water reuse and reclamation at Schweppes Ltd., Aylesbury, UK. The reuse process employs biological treatment, sand filtration, chlorination, activated carbon treatment, and pasturization. When the high costs of water intake and sewage disposal are considered, the water reuse system realizes a net annual savings of about 40,000 pounds sterling even when 12% is allowed for amortization and interest payments on capital. (Small-FRC)
W80-00257

CURRENT TECHNOLOGY AND RESEARCH ON RE-USE OF EFFLUENTS,
National Inst. for Water Research, Pretoria (South Africa).
G. G. Cillie.
Saccap Action News, Vol. 3, No. 2, p 10-13, 1977. 2 fig.

Descriptors: *Recycling, *Sewage treatment, *Waste water treatment, *Biological treatment, Irrigation, *Chlorination, Lime, Separation techniques, Pathogenic bacteria, Nitrogen, Phosphorus, Organic compounds, Heavy metals.

Current effluent reuse practices and processes available for renovating waste waters are reviewed. In South Africa, of the 1230 ml/day purified sewage effluents produced, 31.9% is reused. Of this, 16.1% is used for irrigation, 8.7% for power plant cooling systems, and 7.1% for industrial purposes. The various waste water treatment processes used to renovate waters remove nitrogen, phosphorus, organic carbon, dissolved minerals, heavy metals, pathogens, and toxicants. Biological treatment and chlorination are used for the removal of nitrogenous compounds, and bacterial treatment and chemical precipitation are used to control phosphorus. Lime treatment removes heavy metals, biological oxidation and activated carbon remove organic carbon compounds, and ion exchange, reverse osmosis, and electrodialysis are used for demineralization. Pathogens are removed by irradiation and chemical treatment such as chlorination. The Windholk plant which reclaims potable water from conventional biofilter sewage effluent is described. (Small-FRC)
W80-00258

MODERNISED SYSTEM FOR CAPE TOWN.
Construction in South Africa, Vol. 22, No. 12, p 42-43, 45, 47, 1978. 4 fig.

Descriptors: *Municipal wastes, *Treatment facilities, *Recycling, *Outlets, Activated sludge, Water purification, Aeration, Sewage treatment.

The modernization and extension of Cape Town's municipal sewage treatment facilities are described. At the new Camps Bay sea outfall, sewage is macerated, screened, chlorinated, and 5 megaliters/day are discharged 1500 m from shore at a depth of 25 m. Plans for the Athlone treatment works are described which include diversion of some municipal and industrial wastes so that effluent meets General Standards with the possible exception of salinity. A parallel activated sludge plant may be necessary at Athlone, and construction of new inlet works is planned. The Cape Flats reclamation works is described which will replace the existing oxidation ponds with a conventional aerated activated sludge system with added anaerobic, anoxic, and aeration zones to complete denitrification. Public relation campaigns are planned to persuade the public that it is possible to reclaim water. The Mitchells Plain treatment works is also described which will be a part of a planned city-

within-a-city and is expected to handle 50 megaliters per day. (Small-FRC)
W80-00259

THE PUMPING OF WATER FROM MINES IN THE CENTRAL WITWATERSRAND,
East Rand Proprietary Mines, Ltd., Boksburg (South Africa).
J. A. Tyser.
Journal of the South African Institute of Mining and Metallurgy, Vol. 77, No. 10, p 207-213, 1977. 6 fig.

Descriptors: *Acid mine water, *Lime, *Water treatment, *Treatment facilities, Aeration, Coagulation, Mine water, Industrial wastes.

A system for the removal and treatment of mine water from underground mines in the central Witwatersrand, South Africa, is described. The water is pumped by a pump station on 24 level to a surface lime plant and a treatment plant. The mine water is acidic (pH 3.5) and contains a high proportion of solids. After the addition of lime, the water is treated to produce water with a minimum pH of 5.5 and less than 25 ppm suspended solids and discharged into a public stream. The plant is comprised of two concrete thickeners, two concrete lime-mixing tanks, and four concrete aeration tanks. Sludge is pumped to a reduction plant where it is used for repulping or directly to the slimes dam. (Small-FRC)
W80-00260

SEWAGE TREATMENT - THE STATE OF THE ART,
Johannesburg City Council (South Africa).
C. Davis.
Construction in South Africa, Vol. 22, No. 12, p 34, 35, 37, 39, 41, 1978. 3 fig.

Descriptors: *Sewage treatment, *Activated sludge, *Nitrates, *Phosphates, *Biological treatment, *Tertiary treatment, Ion exchange, Chemical precipitation, Water purification, Sludge disposal.

A review of current sewage treatment methods is presented. Variations of the activated sludge process are described including pure oxygen aeration. The removal of nutrients such as nitrates and phosphates can be performed by chemical means such as precipitation and ion exchange, and by more recently developed biological means. Nitrate removal utilizes bacteria which, when deprived of free oxygen, change to an anoxic metabolism in which they derive oxygen from nitrate. Tertiary treatment methods which can produce drinking water from sewage effluent are discussed. A common process stream is: coagulation, sedimentation, ammonia stripping, sand filtration, activated carbon adsorption, and chlorination. Sludge disposal methods are discussed and alternatives to water-borne sewage systems are mentioned. (Small-FRC)
W80-00261

PRESSURE FILTERS FOR SPECIALISED WASTEWATER TREATMENT.
Energy, Vol. 3, p 25, 27, May 1977. 2 fig, 1 tab.

Descriptors: *Filtration, *Water pressure, *Radioactive wastes, *Waste disposal, Activated carbon, Ion exchange, Diatomaceous earth, Drying, Waste storage.

Pressure filters using a diatomaceous earth, activated carbon or ion exchange resin powder precoat are used for the treatment of nuclear power plant waste water. The pressure filters remove solid radioactive residues and the slurrys are piped to a central collection plant where final filtration and drying take place. The dry radioactive residues are enclosed and solidified in drums of bitumen and removed to a final storage site. (Small-FRC)
W80-00264

STANGER PULP AND PAPER MILL - CLEARING THE WATER.
Prospect, Vol. 16, No. 4, p 16-18, 1977.

Descriptors: *Pulp and paper industry, *Industrial wastes, *Incineration, *Recycling, Suspended solids, Aeration, Dewatering, Landfills, Chemical wastes.

The efforts of Stanger Pulp and Paper of South Africa to control pollution are summarized. The company attempts to recover chemicals used in the production process by burning untreatable toxic effluent and by recycling the treatable effluent. After the bagasse is converted to pulp, excess water is evaporated from the effluent, and the solids are converted to soda ash in Copeland reactors. During paper making, effluent water is discharged, collected, and pumped to the treatment plant where large solid particles are removed, and clarification and aeration take place. Residual sludge is dewatered and used as landfill. (Small-FRC)
W80-00265

BOTANICAL CONTROL: PURIFYING INDUSTRIAL WASTEWATER,
J. Joseph.
Municipal Engineer, Vol. 9, No. 4, p 49, 51, 53, 1978. 1 fig.

Descriptors: *Water hyacinth, *Industrial wastes, *Aquatic plants, *Waste water treatment, *Absorption, Phenols, Pesticides, Chemical wastes, Metals, Strontium, Performance.

The use of water hyacinths to purify industrial waste water is discussed. Field studies performed by the National Aeronautics and Space Administration demonstrated that hyacinths can be used to remove a broad spectrum of industrial wastes. Within as short a time span as 24 hours, water hyacinths can absorb most of the chemical and organic contaminants in industrial effluent, including phenols, pesticides, rare polluting metals, and strontium. For example, approximately half a hectare of water hyacinths can absorb and remove 105.6 grams of lead over a twenty-four hour period. Mevinphos can be removed, adsorbed, metabolized and concentrated by a number of vascular aquatic plants. Join-grass and water lily removed from 87 to 93 ppm of Mevinphos from test systems in less than two weeks without apparent damage to the plants. Thus far, investigations have revealed no significant industrial pollutants which can not be removed by vascular aquatic plants. Normal concentrations of the wastes do not even slow the growth of the plants. (Small-FRC)
W80-00266

ROODEPOORT NOW HANDLES OWN WASTEWATER,
J. H. Snell.
Imiesa, Vol. 3, No. 3, p 13-15, 1978. 5 fig, 1 tab.

Descriptors: *Domestic wastes, *Treatment facilities, *Municipal wastes, *Activated sludge, Chlorination, Waste disposal, Nitrogen, Phosphorus, Anaerobic treatment, Aerobic treatment, Aeration.

The Driefontein Water Pollution Control Works of the City of Roodepoort is described. Roodepoort was initially served by several small activated sludge units and by the facilities in nearby Johannesburg. The new Roodespoort facility has a capacity of 14 Ml/day for preliminary treatment and 7 Ml/day as an average dry weather flow. The Phoredox system is utilized: anaerobic zone, anoxic zone, aerobic zone, second anoxic zone, and reaeration. The system is designed to remove more than 75% nitrogen and 50% phosphorus. Effluent from the sedimentation tanks will be chlorinated and discharged into the Crocodile River; the phosphorus-rich filtrate will be disposed of on land. The plant should meet the community's needs until 1983. (Small-FRC)
W80-00267

ANALYSIS OF WASTEWATER LAND TREATMENT SYSTEMS IN THE PHOENIX URBAN AREA,
Boyle Engineering Corp., Phoenix, AZ.
R. L. Ewing.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section- American Water Resources Assn. and the Hydrology Section- Arizona Academy of Sciences, April 14-15, 1978, Flagstaff, Az., Vol. 8, p 26-32, 3 fig, 11 ref.

Descriptors: *Waste water treatment, *Environmental sanitation, *On-site investigations, *Sewage treatment, *Alternate planning, Recycling, Water pollution treatment, Effluents, Computer programs, Economic feasibility, Phoenix, Arizona.

Wastewater land treatment systems are ideally suited for the treatment of primary and secondary treatment plant effluents in the Phoenix area and other arid desert regions where water is a scarce and valuable resource. The site specific nature of such systems necessitates the preliminary investigation and comparison of a large number of alternative techniques to facilitate a realistic economic and engineering evaluation. Reported is a summary of a computer analysis technique designed to analyze each site based upon factual site specific criteria, as to its suitability to irrigation, infiltration-percolation, and overland flow methods of land application of wastewater. Criteria considered in this initial evaluation process were the general location as it related to the existing wastewater system and its compatibility with proposed land usage in the general proximity, the general environmental setting including climate, topography, soil characteristics, groundwater conditions as well as the identification of historically and archaeologically sensitive areas, appropriate costs, power usage and land requirements. To date the Phoenix area '208'/urban study has evaluated approximately 35 sites with a total of over 50 land treatment alternatives being considered. 27 of 35 sites have been eliminated. (Tickes-Arizona)
W80-00272

LAND TREATMENT OF PRIMARY SEWAGE EFFLUENT: WATER AND ENERGY CONSERVATION,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
R. C. Rice, and R. G. Gilbert.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, April 14-15, 1978, Flagstaff, Az., Vol. 8, p 33-36, 2 tab, 7 ref.

Descriptors: *Waste treatment, *Waste water treatment, *Water pollution treatment, *Water conservation, Activated sludge, Sewage effluents, Cost-benefit analysis, Feasibility studies, Energy budget, Water quality, Alternative planning, Effluents, Conservation.

A cost and energy budget analysis of land treatment of primary sewage effluent is presented to illustrate how these techniques are cost-effective and energy saving alternatives for wastewater treatment that eliminate the cost and energy requirements of the more conventional secondary activated sludge treatment and produce high quality renovated water. Preliminary laboratory and field studies have shown that primary effluent can be successfully treated by land application and yield water whose quality equals that of renovated secondary effluent at about half the energy requirement. (Tickes-Arizona)
W80-00273

EFFECT OF ALGAL GROWTH AND DISSOLVED OXYGEN IN REDOX POTENTIALS IN SOIL FLOODED WITH SECONDARY SEWAGE EFFLUENT,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
R. G. Gilbert, and R. C. Rice.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, Flagstaff, Az., 1978, p 132-136, 2 fig, 15 ref.

Descriptors: *Algae, *Algal control, *Waste water treatment, *Effluents, *Microbial degradation,

*Nitrogen cycle, Dissolved oxygen, Nitrification, Chemical reactions, Soil-water-plant relationships, Environmental effects, Sewage treatment, Growth stages, Denitrification.

The land application of wastewater has been shown to be an effective method for the renovation of secondary sewage effluent (SSE) although the nitrifying activity associated with this treatment has been related to the growth and activity of algae. The objectives of this study were therefore to investigate the effects of algal growth on dissolved oxygen and Eh in soil basins flooded with SSE and to locate and characterize those regions in the soil-water system, during flooding periods, where microbial processes and environmental conditions were favorable for denitrification and the N-removal from the SSE. Flooding and drying cycles of 14 days each were carried out at the Flushing Meadows Project Experimental Site in the Salt River bed near Phoenix, Arizona that maximized hydraulic loading and produced N-removal rates of about 30% while the water table below the soil basin rose from 3 to 2 m deep during flooding. Results indicated that nitrification, which must occur before denitrification can proceed, was associated with the growth and development of algae on the surface of the soil basin during each flooding period. The daily activity of algae produced diurnal fluxes of DO and Eh that induced conditions favorable for nitrification. Subsequently, the nitrate-N and/or nitrate-N formed would be denitrified, while infiltrating through the reduced zones of the organic sediments and surface 2 cm of soil. (Tickes-Arizona)
W80-00286

BOD/TOC CORRELATIONS AND THEIR APPLICATION TO WATER QUALITY EVALUATION,
Waterloo Univ. Research Inst. (Ontario).
T. W. Constable, and E. R. McBean.
Water, Air, and Soil Pollution, Vol. 11, No. 3, p 363-375, April 1979. 8 fig, 2 tab, 13 ref.

Descriptors: *Water quality, *Biochemical oxygen demand, *Carbon, *Model studies, Mathematical models, Effluents, Sewage effluents, Organic matter, Microbial degradation, Microorganisms, Waste treatment, Biological treatment, Sewage treatment, Model comparisons.

The error residual for TOC analysis was examined with the result that two BOD5/TOC models were suggested, both of which use a multiplicative error structure. A comparison of these models with the historically-assumed linear BOD5/TOC model was created for data collected from the City of Waterloo Water Pollution Control Plant. The predictive capabilities of the derived BOD5/TOC models were examined for interpolation and extrapolation potentials for augmenting water quality data information bases. Use of the models to reduce the statistical uncertainty associated with BOD measurements was considered. (Sims-ISWS)
W80-00353

THE UPTAKE OF 226RA BY PLANKTONIC ALGAE UNDER CONDITIONS OF CONTINUOUS CULTIVATION,
Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Dept. of General Public Hygiene.
For primary bibliographic entry see Field 5A.
W80-00394

5E. Ultimate Disposal Of Wastes

DEVELOPMENT OF A SYNTHETIC MUNICIPAL LANDFILL LEACHATE,
Wisconsin Univ.-Madison.
R. Stanforth, R. Ham, M. Anderson, and R. Stegmann.
Journal of the Water Pollution Control Federation, Vol. 51, No. 7, p 1965-1975, July 1979. 4 fig, 8 tab, 14 ref.

Descriptors: *Landfills, *Leaching, *Model studies, Mathematical models, Chemicals, Wastes, Waste disposal, Degradation, Leachate, Acids, Industrial wastes, Municipal wastes, Hydrogen ion concentration, Oxidation-reduction potential, Organic compounds, Ions, Aerobic conditions, Synthetic leachate.

The development of a synthetic municipal landfill leachate for use in laboratory leaching tests on industrial wastes was described. The parameters most likely to be of importance in leaching materials from industrial wastes were identified, and the concentrations of those parameters found in agressive landfill leachate were determined by a literature search. Compounds were chosen to model the parameters and were combined in a synthetic leachate at the concentrations necessary for aggressive landfill leachate. (Sims-ISWS)
W80-00071

2ND USA/USSR SYMPOSIUM ON PHYSICAL/CHEMICAL TREATMENT FROM MUNICIPAL AND INDUSTRIAL SOURCES, HELD AT THE TAFT CENTER, CINCINNATI, OHIO, NOVEMBER 12-14, 1975.
For primary bibliographic entry see Field 5D.
W80-00097

PROCESSING AND NEUTRALIZATION OF INDUSTRIAL WASTES FROM IRON AND STEEL EFFLUENTS TREATMENT,
For primary bibliographic entry see Field 5D.
W80-00114

FUNDAMENTAL PRINCIPLES OF SELECTING THE METHOD FOR PROCESSING SEWAGE SEDIMENTS IN ACCORDANCE WITH THEIR PROPERTIES,
For primary bibliographic entry see Field 5D.
W80-00115

PRELIMINARY EVALUATION OF ANAEROBIC SLUDGE DIGESTION FOR THE TUNA PROCESSING INDUSTRY,
Washington Univ., Seattle. Sea Grant Program.
A. Kissam, H. Barnett, F. Stone, and P. Hunter.
In: Proceedings of the 8th National Symposium on Food Processing Wastes, March 30-April 1, 1977, Seattle, Washington, p 155-168, 1977. 1 fig, 5 tab, 18 ref.

Descriptors: *Anaerobic digestion, *Food processing industry, *Sludge treatment, *Suspended solids, Economics, Performance, Sludge disposal, Screens, Flotation.

An anaerobic digestion demonstration project for the treatment of tuna processing sludge is described and discussed. The test sludge was obtained from a plant which treated waste water by screening followed by dissolved air flotation using 200 ppm alum, 100 ppm lime, and 5 ppm anionic acids. Removal and operating parameters are presented for three digester detention times: 8, 12, and 15 days. Using the system, a total dry solids loading of 6100 pounds per day would be reduced by 55% with anaerobic digestion. A total annual reduction in expenses of $78,000 is projected. Use or marketing of the methane gas produced by the digester could result in further savings. (See also W80-00116) (Small-FRC)
W80-00127

PHYSICAL AND ENGINEERING PROPERTIES OF HAZARDOUS INDUSTRIAL WASTES AND SLUDGES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 8G.
W80-00243

IMMOBILIZATION OF HAZARDOUS RESIDUALS BY ENCAPSULATION,
Washington State Univ., Pullman. Dept. of Materials Science and Engineering.
For primary bibliographic entry see Field 5D.
W80-00256

OPERATION AND CONTROL OF WATER PURIFICATION PLANTS, PART II,
National Inst. for Water Research, Pretoria (South Africa).
J. R. H. Hoffman.
Imiesa, Vol. 2, No. 4, p 19-23, 1977. 2 fig.

Descriptors: *Water purification, *Filtration, *Chlorination, *Settling basins, Operations, Performance, Flow rates, Disinfection.

This second part of a series on operation and control of water purification plants discusses sedimentation, filtration, and chlorination. Horizontal flow and upward flow settling tanks are described and their proper operation is discussed. Filtration to remove particles not settled out is discussed including considerations of filtering media, the hydraulics of filtration, backwashing, filter performance, and filter rate control. Chlorine disinfection is explained through descriptions of the chemistry of chlorine in water, break-point chlorination, the design of chlorine contact tanks, and levels of chlorine residuals which should prevail in the distribution system. (Small-FRC)
W80-00262

THE USE OF FERRIC CHLORIDE AS A FLOCCULATING AGENT IN THE TREATMENT OF DRINKING WATER,
N. J. H. Grobbelaar, and H. R. Ernst.
Energy, Vol. 3, p 23, 27, May 1977. 1 tab.

Descriptors: *Flocculation, *Chlorides, *Water purification, *Potable water, Operations, Performance, Costs.

Successful flocculation using ferric chloride is described including its use when water works are overloaded or poorly designed. A new process which produces ferric chloride as a 43% (m/m) solution at a competitive price has made this process feasible for South African plants. The physical properties of ferric chloride solution are described, and the various operations involved in the treatment process are exaplained. Important flocculant parameters include the time of formation which influences retention time, and the time it takes for complete settling to take place. A trial run is necessary to determine the usefulness of ferric chloride for a particular operation. (Small-FRC)
W80-00263

5F. Water Treatment and Quality Alteration

TRICKLE IRRIGATION: PREVENTION OF CLOGGING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
R. G. Gilbert, F. S. Nakayama, and D. A. Bucks.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 2, p 514-519, May-June 1979. 4 fig, 4 tab, 17 ref.

Descriptors: *Irrigation, *Colorado River, *Clogging, *Irrigation operation and maintenance, Irrigation practices, Water treatment, Chemicals, Water quality, Suspended solids, Bacteria, Filters, Filtration, On-site investigations, Agriculture, *Trickle irrigation, Emitter clogging.

Trickle irrigation experiments using Colorado River irrigation water on citrus trees in southwestern Arizona were conducted to evaluate clogging of emitters and to investigate methods for controlling clogging. Clogging is related to the water quality in terms of the suspended sediment load, chemical composition, and biological activity. Various combinations of 6 water treatments, including screen and sand filtration coupled with additions of hypochlorite and acid, were used with 8 different trickle emitters to evaluate long-term prevention of clogging. Five of the 8 emitter systems under study (No. 1, 5, 6, 7, and 8) required sand and screen filtration (200-mesh) plus chemical treatments to prevent physical clogging of the emitters by suspended materials and to maintain flow rates greater than 70% of the design flow. Three emitter systems (No. 2, 3, and 4) continued to operate at

greater than 80% of the design flow rate with only screen filtration (50-mesh). The results after 2 yr have indicated that clogging of emitters could be prevented by proper treatment of Colorado River water, which includes in the following order of preference: (1) filtration system for prevention of the rapid physical clogging of emitters caused by suspended materials, (2) chemical treatments for long-term prevention of chemical clogging of emitters caused by precipitation of carbonates, and (3) chemical treatments for long-term prevention of biological clogging of emitters caused by microbial growth and slime development. (Sims-ISWS)
W80-00074

ALGAL ASSAYS FOR AREAS RECEIVING OR PROGRAMMED TO RECEIVE SEWAGE EFFLUENT,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5A.
W80-00193

RICHARDS BAY MZINGAZI WATER PURIFICATION WORKS,
D. Langenegger, and P. B. B. Vosloc.
Municipal Engineer, Vol. 9, No. 1, p 71-73, 1978. 4 fig.

Descriptors: *Water purification, *Chlorination, *Filtration, *Flocculation, *Potable water, Treatment facilities, Lime, Water quality, Lakes, Reservoirs.

Preliminary studies and the design of the Mzingazi Water Purification Works are reviewed. A water treatment plant was designed to treat water from the Mzingazi Lake to provide potable water for the developing community of Richards Bay. Initially, a temporary treatment plant was utilized while the water quality of the lake was evaluated. In the temporary plant problems occurred with proper flocculation, and in the final design, stepwise addition of aluminum sulfate was planned. Because of development along the edges of the lake and the accompanying deterioration of water quality, prechlorination was investigated as a possibility for the future. In the final plan, water will be dosed with aluminum sulfate, mixed, and then filtered. Chlorine is added and lime is used to raise the pH. The water will be stored in two reservoirs. (Small-FRC)
W80-00268

NITROGEN REMOVAL FROM SECONDARY EFFLUENT APPLIED TO A SOIL-TURF FILTER,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering; and Oklahoma State Univ., Stillwater. Soil Testing Lab.
E. L. Anderson, I. L. Pepper, and G. V. Johnson.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Az., p 37-44, 4 fig, 2 tab, 17 ref.

Descriptors: *Turf grasses, *Filters, *Trickling filters, *Waste water treatment, *Water pollution treatment, *Effluents, *Nitrogen, Water pollution sources, Lysimeters, Drip irrigation, Sands, Leachate, Water quality.

The potential of soil-turfgrass filters as a tertiary treatment for secondary effluent was investigated in this study conducted at the University of Arizona Turfgrass Research Center in Tucson, Arizona. Twenty lm2 by 60 cm deep lysimeters were arranged in a split plot design with 2 different soils, a sand and a sand mixture, 5 application rates of 10, 17, 22, 34 and 43 mm/day applied twice daily, with 15 mm drip irrigation lines with two replicates of each rate. Results indicated that sand had a higher percent recharge than the mix while the mix soil had a higher purification efficiency and percent utilization than sand. The maximum rate of effluent application in sand that yielded leachate averaging less than 10 ppm NO3 -N was 22 mm/day while on the sand mixture 43 mm/day yielded leachate meeting this criterion. This study demonstrates the potential of soil turfgrass as a tertiary treatment for secondary effluent particularly in arid regions where water is a limited resource. (Tickes-Arizona)
W80-00274

WASTEWATER REUSE-HOW VIABLE IS IT. ANOTHER LOOK,
Stevens, Thompson and Runyan, Inc., Phoenix, AZ.
W. L. Chase, and J. Fulton.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Az. p 110-114, 2 tab.

Descriptors: *Waste water treatment, *Water reuse, *Water resources planning, *Economic feasibility, Water pollution control, Community development, Comprehensive planning, Alternate planning, Water quality control, Sludge treatment, Cost analysis, Salt River Valley, Arizona, Hydrologic budget, Water shortage.

Water reuse in the Phoenix area is analyzed in terms of both the problems that must be solved and the advantages that a well planned reuse system would bring. In the absence of a generally accepted agreement on the seriousness of the long-term water shortage in the Salt River Valley, it is difficult for these communities to decide upon which reuses are viable, what level of treatment is required for those reuses, and how much they are willing to pay for additional sources of water. The wastewater treatment alternatives that are being discovered through the 208 water quality program such as the conventional vs. land treatments, alternative collection systems; and different methods of sludge collection, treatment, and disposal are enumerated and cost analyzed while pointing out the many problems that must first be solved. (Tickes-Arizona)
W80-00283

THERMAL ALTERATION OF GROUNDWATER CAUSED BY SEEPAGE FROM A COOLING LAKE,
Northern Cheyenne Research Project, Lame Deer, MT.
For primary bibliographic entry see Field 5B.
W80-00358

5G. Water Quality Control

SCALE-INHIBITING COMPOSITIONS FOR AQUEOUS SOLUTIONS,
Establissements Kuhlmann, Paris (France). Produits Chimiques.
H. Roques, and A. Girou.
U.S. Patent No. 4,148,728, 6 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 2, p 604, April 10, 1979.

Descriptors: *Patents, *Scaling, *Water quality control, Industrial water, Desalination apparatus, Calcium carbonates, Water treatment, *Fluorocarbons.

The invention is based upon a study of the type of activity exhibited by fluorocarbons, as well as the activity of conventional boiler compounds, in order to provide scale-inhibiting compounds with excellent performance. It has been found that the fluorocarbon derivatives can affix themselves to a substrate and provide antiscaling properties, with activity at the heterogeneous germination level, and that they will inhibit scale deposits on the surfaces of substrates studied. The invention also provides methods for treating aqueous solutions and surfaces to prevent scale formation on such surfaces. (Sinha-OEIS)
W80-00005

WATER QUALITY MANAGEMENT ACCOMPLISHMENTS COMPENDIUM I.
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 6E.
W80-00242

PLANNING FOR ENVIRONMENTAL MANAGEMENT: NEW DIRECTIONS AND INITIATIVES,
Research Group, Inc., Atlanta, GA.
For primary bibliographic entry see Field 6E.
W80-00386

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

THEORY AND APPLICATION OF ENVIRONMENTAL ECONOMICS,
Vrije Univ., Amsterdam (Netherlands).
P. Nijkamp.
Studies in Regional Science and Urban Economics, Volume 1. A. Andersson and W. Isard, Eds., North-Holland Publishing Company, Elsevier North-Holland, Inc., New York, N.Y., 1977. 332 p.

Descriptors: *Environmental control, *Economics, *Analytical techniques, *Ecology, *Optimization, *Environmental quality, Water quality, Air pollution, Cost-benefit analysis, Design, Mathematical models, Equations, Systems analysis, Decision making, Degradation(Decomposition), Political aspects, Ethics, Welfare, Interdisciplinary, Regional science, Urban economics, Social aspects, Conceptual frameworks, Data, Market mechanism, Uncertainty.

This monograph is the first in a series designed to give to a wide audience with transdisciplinary interests the most advanced contributions to analysis in the fields of regional science and urban economics. It attacks the problem of environmental management. The economics considered is a very broad-ranging one which introduces basic social, political, and cultural factors into the analysis, including ethics and key welfare considerations. An advanced textbook on the economic aspects of environmental problems, the monograph aims to (1) provide theoretical insight into economic aspects of environmental problems by presenting broad surveys of existing theories; (2) achieve mastery of a set of new theories and methods in environmental economics by developing new tools for dealing with intangibles; and (3) contribute to an operational analysis of environmental problems by presenting various empirical applications. The individual chapters consider: (1) economics and ecology--a synthesis; (2) ecologic valuation of natural environments; (3) environmental externalities; (4) programming models for environmental quality analysis; (5) equilibrium and growth models; (6) costs of environmental damage and management; (7) cost-benefit analysis for environmental design; (8) multi-objective optimization model; for decision making; (9) dynamic multi-objective modeling and environmental quality analysis; (10) optimal control of exhaustible resources; (11) multi-criteria analysis; (12) alternative approaches to uncertainty; and (13) urban problems, environmental profiles, and spatial mobility. (Bell-Graf--Cornell)
W80-00027

COMMENT ON 'VALUE OF INFORMATION IN RESERVOIR OPTIMIZATION' BY V. KLEMES,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
R. Krzysztofowicz.
Water Resources Research, Vol. 15, No. 4, p 973-975, August 1979. 1 fig, 7 ref.

Descriptors: *Reservoirs, *Optimization, *Value, *Information, *Asymptotic behavior, *Uncertainty, Water resources, Management(Applied), Reservoir storage, Reservoir releases, Mathematical models, Systems analysis, Equations, Control law, Quadratic loss function, Loss minimization, Expected value criterion, Bayesian.

Field 6—WATER RESOURCES PLANNING

Group 6A—Techniques Of Planning

Reviewed is a paper by Klemes (1977) (See W78-02445) which broaches a subject of considerable importance in the theory and practice of management of water resource systems. Clarification is made of a few points in Klemes' paper. In particular: (1) the asymptotic behavior of the optimal control law for a reservoir with a quadratic loss function is shown theoretically and its implications for Klemes' work are discussed; (2) Klemes' speculations on the dependence between the value of an increment of information and the system's complexity are questioned; and (3) an alternative Bayesian interpretation of the expected value criterion is given. (Bell-Graf--Cornell)
W80-00147

PERSPECTIVES ON LAKE ECOSYSTEM MODELING.
For primary bibliographic entry see Field 2H.
W80-00204

PREDICTIVE WATER QUALITY MODELS FOR THE GREAT LAKES: SOME CAPABILITIES AND LIMITS,
McMaster Univ., Hamilton (Ontario).
For primary bibliographic entry see Field 2H.
W80-00211

A MINIMUM-COST SURVEILLANCE PLAN FOR WATER QUALITY TREND DETECTION IN LAKE MICHIGAN,
Analytic Sciences Corp., Reading, MA.
L. M. DePalma, R. P. Canale, and W. F. Powers.
In: Perspectives on Lake Ecosystem Modeling, p 223-246, 1979. 1 fig, 6 tab, 20 equ, 27 ref, 1 append.

Descriptors: *Water quality, *Lake Michigan, *Sampling, *Cost minimization, *Stochastic processes, *Statistical methods, *Model studies, *Design, *Trend detection, Optimization, Measurement, Long-term planning, Constraints, Systems analysis, Equations, Total phosphorus, Linear filter theory, Surveillance programs, Chloride, Cost effectiveness, Mass balance models, Concentrations, Kalman filter, Nonlinear stochastic difference equations, Uncertainty.

Developed is a systematic approach for designing least-cost sampling strategies for trend detection in large lakes. The uncertain parameters in a simple model for lakewide average concentrations of chloride and total phosphorus are characterized statistically. The model is interpreted as nonlinear stochastic difference equations which can be used, along with lake measurements, in a linearized Kalman filter. The approach uses statistical characterizations of mass balance models; the accuracy of the parameters in the mass balance models for lakewide average concentrations is examined for Lake Michigan. The combined procedures are used to determine the spatial and temporal frequency of sampling required to detect year-to-year trends. Minimum-cost surveillance plans are computed which meet accuracy criteria of the Kalman filter estimates. The analyses indicate that tributary samples are not a cost-effective source of information for estimating long-term lakewide average concentration, and that lake samples should be collected only for those years when the accuracy criteria must be satisfied. Furthermore, optimal cost for long-range trend detection is more sensitive to the accuracy of the phosphorus apparent settling velocity and of the laboratory analyses than to the accuracy of the effective Straits of Mackinac flow or the atmospheric loads. (See also W80-00204) (Bell-Graf--Cornell)
W80-00213

BACKWATER AT BRIDGES AND DENSELY WOODED FLOOD PLAINS, TALLAHALA CREEK AT WALDRUP, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.; and Geological Survey, Montgomery, AL. Water Resources Div.; and Geological Survey, Baton Rouge, LA. Water Resources Div.
B. E. Colson, C. O. Ming, and G. J. Arcement.
Available from Branch of Distribution, USGS 1200 S. Eads St. Arlington, VA 22202 price $11.25. Geological Survey Hydrologic Investigations Atlas HA-590, 1978. 9 sheets, 4 fig, 4 tab, 10 ref.

Descriptors: *Flood data, *Flood flow, *Data collections, *Model studies, *Open channel flow, Streamflow, Peak discharge, Flood plains, Alabama, Louisiana, Mississippi, Flood profiles, Bridges, Backwater, Flow around objects, Streamflow forecasting, Analytical techniques, Vegetation, Embankments, Forest watersheds, Mannings equation, Digital computers, Evaluation, *Tallahala Creek(MS).

Floodflow data that will provide a base for evaluating digital models relating to open-channel flow were obtained at 22 sites on streams in Alabama, Louisiana, and Mississippi. Thirty-five floods were measured. Analysis of the data indicated that backwater and discharges computed by standard indirect methods currently in use would be inaccurate where densely vegetated flood plains are crossed by highway embankments and single-opening bridges. This atlas presents flood information at the site on Tallahala Creek at Waldrup, Miss. Water depths, velocities, and discharges through bridge openings on Tallahala Creek at Waldrup, Miss., for floods of April 14, 1969, February 21, 1971, and April 13, 1974, were measured together with peak water surface elevations along embankments and along cross sections. Manning's roughness coefficient values in different parts of the flood plain are shown on maps, and flood-frequency relations are shown on graphs. (Woodard-USGS)
W80-00241

MANAGEMENT ALTERNATIVES FOR SANTA CRUZ BASIN GROUNDWATER,
Arizona Univ., Tucson. Office of Arid Lands Studies.
K. E. Foster.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Arizona, p 202-208, 3 fig, 10 ref.

Descriptors: *Groundwater basins, *Water management(Applied), *Groundwater availability, *Water resources development, *Alternate planning, Sewage effluents, Water supply, Groundwater recharge, Water balance, Water shortage, Colorado River, Water sources, Municipal wastes, Water rights, Inter-basin transfers, Economic aspects, Political aspects, Water allocation(Policy), Water table, Southwest US, Arizona, River basins.

An analysis of current groundwater usage levels in the Santa Cruz Basin for agricultural, municipal, private, industrial and mining applications indicates an annual water balance deficit of 74,000 acre feet. Various techniques for reducing these current groundwater level declines including: (1) importing water from the Colorado River, (2) exchanging municipal sewage effluent with mines or farms for their fresh water rights, (3) interbasin transfers of water, (4) retiring farmlands for water rights and combinations thereof, are discussed here to illustrate the economic, political and physical aspects of developing this water source that must be considered. It is hoped that this discussion of the Santa Cruz River Basin, a typical example of the Basin-and-Range physiograohic provinces in the southwestern U.S., will be applicable to most economically emergent urban areas in arid and semiarid regions. (Tickes-Arizona)
W80-00296

MINNESOTA PEAT PROGRAM: MANAGEMENT GOALS AND OBJECTIVES AND POLICY ALTERNATIVES.
Minnesota Department of Natural Resources, April, 1979. 38 p. 2 append.

Descriptors: *Peat, *Minnesota, *Regulation, Wetlands, Bogs, Marsh management, Management.

Policy statements are given which summarize the results of an evaluation of policy alternatives for peatland management. Detailed evaluations of policy issues including alternatives and justification for determining each policy are presented. (Steiner-Mass)
W80-00316

APPLYING PROBABILISTIC WATER QUALITY STANDARDS IN RIVER BASIN WATER QUALITY OPTIMIZATION MODELS,
Calgary Univ. (Alberta).
M. B. Bayer.
In: Water Pollution Research in Canada 1974. Incorporating the Proceedings of the 9th Canadian Symp. on Water Pollution Research, Western Ontario Univ., February 1974. J.E. Zajic and N. Kosaric, Eds., p 25-29. 3 tab, 2 equ, 20 ref.

Descriptors: *Water quality, *Standards, *Probability, *River basins, *Dissolved oxygen, *Biochemical oxygen demand, *Nonlinear programming, Waste water treatment, Treatment facilities, Estimating, Optimization, Mathematical models, Equations, Systems analysis, Boundary values, Maximum likelihood, Cost minimization.

Described is a method of applying probabilistic dissolved oxygen (DO) and biochemical oxygen demand (BOD) standards in river basin water quality models. Maximum likelihood estimators for the DO and BOD concentrations variances for each reach are used to obtain a lower bound for BOD so that the probability of violating specified DO and BOD standards is less than 0 percent in any reach. These boundary values for DO and BOD concentrations are incorporated into a nonlinear water quality optimization model for finding the minimum cost set of wastewater treatment plant efficiencies required to meet DO and BOD standards. The method also provides the minimum DO concentration and the maximum BOD concentration which may be expected to occur 1-0 of the time for any reach. (Bell-Graf--Cornell)
W80-00342

REAL-TIME PREDICTOR VERSUS SYNTHETIC HYDROLOGY FOR SEQUENTIAL RESERVOIR MANAGEMENT,
Milan Univ. (Italy). Ist. di Elettrotecnica ed Elettronica; and Centro Teoria dei Sistemi, Milan (Italy).
G. Ambrosino, G. Fronza, and G. Guariso.
Water Resources Research, Vol. 15, No. 4, p 885-890, August 1979. 5 fig, 2 tab, 14 equ, 20 ref.

Descriptors: *Reservoir operation, *Optimization, *Stochastic processes, *Real time, *Sequential procedure, *Predictor, Synthetic hydrology, Decision making, Reservoir releases, Reservoir storage, Dynamic programming, Computer models, Algorithms, Equations, Statistical method, Minimization, Systems analysis, Comparison, Inflow, Methodology.

This paper describes a sequential procedure for reservoir management and compares it with an existing method, the alternate stochastic optimization (ASO) method. Following the ASO approach, at each time step the decision on the release is based upon present storage, present and future target releases, and a number of 'possible' future inflows given by synthetic generation. In the approach described herein, the decision is also based on present storage and present and future targets, but the hydrological input is represented by the 'most likely' future inflow series, namely, by that inflow series forecast by a real time predictor (in the sense of Box and Jenkins). The management performance of the two methods is substantially the same, but the present procedure allows a very conspicuous computational saving. Actually, the optimzation model (a dynamic program which gives the best decision) is run only once at each time step while it is run 20 or 30 times (depending upon the number of synthetic series used) in the ASO approach. (Bell-Graf--Cornell)
W80-00361

OPTIMIZATION OF A DAM SYSTEM FOR RECHARGING RUNOFF WATER INTO THE GROUND,
Tahal Consulting Engineers Ltd., Haifa (Israel).
For primary bibliographic entry see Field 4B.
W80-00362

STOCHASTIC OPTIMIZATION OF A WATER SUPPLY SYSTEM,
Auckland Univ. (New Zealand). Dept. of Theoretical and Applied Mechanics.
M. G. V. Bogle, and M. J. O'Sullivan.
Water Resources Research, Vol. 15, No. 4, p 778-786, August 1979. 5 fig, 8 tab, 20 ref.

Descriptors: *Stochastic processes, *Water supply, *Dynamic programming, *Reservoir operation, *Water policy, *Cost minimization, Optimization, Constraints, Decision making, Reservoir releases, Reservoir storage, Inflow, Probability, Simulation analysis, Equations, Mathematical models, Systems analysis, Steady state, River-reservoir systems.

Stochastic dynamic programming (DP) is employed to derive the operating policy with the least expected steady state cost for a water supply system consisting of a reservoir and an alternative source. The set of possible decisions consists of a number of release rules, each expressing release as a function of storage, rather than a number of discrete releases, as in the conventional DP approach. A flexible procedure is developed which permits inflow to be described by piecewise linear probability density functions, and which removes the constraint that inflow and release must be multiples of the discrete unit of storage. The techniques are applied to a reservoir-river system, and through simulation, the results are compared with the solution found using conventional DP. (Bell-Graf--Cornell)
W80-00397

6B. Evaluation Process

THEORY AND APPLICATION OF ENVIRONMENTAL ECONOMICS,
Vrije Univ., Amsterdam (Netherlands).
For primary bibliographic entry see Field 6A.
W80-00027

AN ECONOMIC AND ENVIRONMENTAL EVALUATION OF ALTERNATIVE LAND DEVELOPMENT AROUND LAKES,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
J. A. Pickering, and R. A. Andrews.
Water Resources Bulletin, Vol. 15, No. 4, p 1039-1049, August 1979. 4 fig, 2 tab, 4 ref. OWRT A-038-NH(3). 14-31-0001-4029.

Descriptors: *Evaluation, *Alternative planning, *Land development, *Lakes, *New Hampshire, Water quality, Phosphorus, Eutrophication, Environmental effects, Economic impact, Residential patterns, Commercial patterns, Land use, Equations, Simplex linear programming, Constraints, Revenue maximization, Water policy, Optimization, Zoning.

Reported herein is a study which made an evaluation of alternative land developments around New Hampshire lakes. Alternative development patterns, evaluated by their impacts on the lake area environment and area economy, included residential patterns, commercial patterns, and combinations of these two types. Phosphorus loading of the lake water was used as a proxy variable for changes in the lake water quality. Commercial developments yielded the highest revenues to the town and the local area. It also attracted the most lake users to the area as well as contributing the largest phosphorus loading in the lake waters. Residential developments, although contributing high revenues to the businessmen in the area, yielded less net income to the town. Phosphorus loading levels from residential developments were much lower than lake phosphorus loading by commercial developments. (Bell-Graf--Cornell)
W80-00148

MODELING MANAGEMENT OF PONDEROSA PINE FOREST RESOURCES,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, AZ.
For primary bibliographic entry see Field 2A.
W80-00228

ECONOMIC ASSESSMENT OF POTENTIAL HAZARDOUS WASTE CONTROL GUIDELINES FOR THE INORGANIC CHEMICALS INDUSTRY,
Little (Arthur D.) Inc., Cambridge, MA.
R. Williams, R. Shamel, K. Hallock, B. Stangle, and S. Blair.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 210, Price codes: A14 in paper copy, A01 in microfiche. Report EPA/530/SW-134c, 1976. 320 p, 6 fig, 130 tab, 2 append.

Descriptors: *Economic impact, *Econometrics, *Chemical industry, *Regulation, *Waste treatment, Water pollution sources, Inorganic compounds, Elasticity of demand, Prices, Hazards.

The economic impact of potential hazardous waste management regulations on the inorganic chemicals industry was analyzed. Inorganic chemicals considered included chlorine and caustic soda, hydrofluoric acid, elemental phosphorus, sodium dichromate, titanium dioxide, aluminum fluoride, chrome pigments, nickel sulfate, phosphorus pentasulfide, phosphorus trichloride, and sodium silicofluoride. The analysis was based on hazardous waste management cost data supplied by the EPA. The defraying of hazardous waste management costs through price increases or the possibility of plant closure due to the cost of management were assessed. Impacts on chemical production were estimated using econometrically-derived demand elasticities. Only hydrofluoric acid would experience a decrease in demand enough to possibly cause plant closures. A 1.6 drop in demand due to higher prices or a 2.9 million dollar drop in sales was projected for hydrofluoric acid. (Small-FRC)
W80-00249

REGIONAL ANALYSIS OF ECONOMIC ACTIVITY, RESOURCE MANAGEMENT AND LAKE EUTROPHICATION: A CASE STUDY OF ITASCA COUNTY, MINNESOTA,
Minnesota Univ., St. Paul. Coll. of Forestry.
For primary bibliographic entry see Field 5C.
W80-00254

TUCSON'S TOOLS FOR DEMAND MANAGEMENT,
Arizona State Water and Sewer Dept., Tucson.
S. E. Davis.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, April 14-15, 1978, Flagstaff, Az. Vol. 8, p 9-15, 2 tab, 2 fig, 3 ref.

Descriptors: *Water demand, *Project post-evaluation, *Water allocation(Policy), *Municipal water, Water management(Applied), Alternate planning, Capital costs, Comprehensive planning, Water consumption(Except consumptive use), Tucson, Arizona.

Tucson, Arizona's 'Beat The Peak' management program initiated on June 1, 1977 is described here to demonstrate how peak management has successfully played an important role in the provision of municipal water resources. Designed to reduce peak water use and facilitate the deferral of costly capital improvements otherwise required, the program has effectuated a reduction in peak day water usage from 151.5 million gallons per day on July 9, 1976 to 114.0 million gallons per day on July 8, 1977. The elements of the program which were a voluntary alternate day outdoor watering program utilizing customer address and date and a voluntary limitation of outdoor watering between 4 and 8 in the afternoon, the utilities hours of highest demand, have led to a 25% reduction in summer usage by the single family class since 1974 and of 15% since 1976. Although the program continues to be a success, areas in which major policy and technical questions remain are listed and discussed. (Tickes-Arizona)
W80-00270

MODEL FOR SELECTION OF STORMWATER CONTROL ALTERNATIVES,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
R. Bedrosyan, and J. Ganczarczyk.
In: Water Pollution Research in Canada 1977. Incorporating the Proceedings of the Twelfth Canadian Symp. on Water Poll. Research, Univ. of Toronto, Feb. 1977 and Eastern Div. Symp., Concordia Univ., Montreal, Dec., '76, p 1-25. 9 fig, 2 tab.

Descriptors: *Water pollution control, *Computer models, *Simulation analysis, *Real-time control, *Alternative planning, *Combined sewers, *Storm runoff, *Cost effective, Performance, Monitoring, Overflow, Treatment facilities, Water resources, Urban runoff, Management, STORM model, RAFFI model, Estimating, Operations research.

Real-time control is a cost-effective pollution abatement alternative, and the computer model RAFFI can be used to evaluate this in the initial planning stage. Despite high initial cost, real-time control helps to use all components of an existing system effectively; moreover, it can be implemented readily in most major combined sewered cities without requiring additional facilities. Despite limitations and simplistic assumptions, RAFFI can be useful when interfaces with STORM in the initial planning stage of a stormwater management study, wherein the behavior of an existing system and all alternative abatement methods can be estimated with a simple, inexpensive continuous simulation model such as STORM-RAFFI over a long period. This will provide a starting point and help to screen a large number of alternatives at low cost. When the number of alternatives is reduced, those more effective ones can be studied with more detailed and expensive models such as WREM. An example given to indicate the potential for STORM-RAFFI shows that simulation with WREM on the Winnipeg study area would cost $300 to $400/run for a single 6-hour critical event with surcharged conditions; output would be very detailed overflow hydrographs, water depths, height of surcharge, etc. The study with STORM-RAFFI would cost only $15 to $20/run for a continuous six month record, yielding much useful information to the decision maker about real-time control or overflow treatment alternatives. (Bell-Graf--Cornell)
W80-00318

A WATER QUALITY ECONOMIC INDEX,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
W. M. Keilani, R. H. Peters, and P. J. Reynolds.
In: Water Pollution Research in Canada 1974. Incorporating the Proceedings of the 9th Canadian Symp. on Water Pollution Research, Western Ontario Univ., February 1974. J.E. Zajic and N. Kosaric, Eds., p 1-24. 8 tab, 8 equ, 9 ref.

Descriptors: *Methodology, *Water quality, *Indices, *Economics, *Statistical methods, *Mathematical models, Evaluation, Decision making, Regional analysis, Equations, Systems analysis, Damage coefficient, Bivariate use, Trends, Laspeyre's formula, Additive model, Multiplicative model, Relative use weights, Parameter rating.

A methodology is presented for producing a water quality economic index which will provide information on the direction and amount of change in water quality on a regional and national basis. It will be useful for evaluation of water quality trends and for economic decision making regarding preventive measures and treatment programs. The methodology consists of statistical and mathematical models, supported by tables, for the different steps in calculating the indices. Two sample indices derived from actual and estimated data are also given. The method utilizes an adaption of Laspeyre's weighted aggregative formula which employs base year weights for construction of indices. Five water quality parameters are assigned to each of twelve water uses. Each parameter value, measured at the actual or potential point of use, is rated between a 'desired objective' of 0 and a 'maximum permissible level' of 100. Each parameter is then given a relative weight out of a total weight of unity to reflect its importance to the use. Relative economic weights for all uses are derived by means

of a damage coefficient. Segments of the index are combined where parameters are common to more than one use, and a bivariate use and parameter economic index is constructed. A set of subgroup bivariate indices by both use and individual parameters is also produced to allow for quality trend evaluation. (Bell-Graf--Cornell)
W80-00346

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE POTENTIAL ECONOMIC USES OF HALOPHYTES,
Scrippts Institution of Oceanography, La Jolla, CA. Foundation for Ocean Research.
P. J. Mudie.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.). Academic Press, Inc., New York, p 565-597, 1974. 1 fig, 5 tab, 121 ref.

Descriptors: *Marsh plants, *Halophytes, *Economics, *Value, Wetlands, Agriculture, Marshes, Benefits, Salt marshes, Natural resources, Food and cover crops, Marsh management.

Halophytes that have some present direct economic value (other than local use for sand-binding or marsh reclamation) are listed along with their reported ranges of salt tolerance and/or their estimated tolerance. Halophytes with minor, subsistence-level uses in restricted areas and those with historical food or medicinal uses are listed in another table. This table also includes halophytes with characteristics that appear to make them suitable for some economic purpose. Most of the species represent incompletely evaluated resources and only tenuous judgments can presently be made concerning their potential usefulness. (Steiner-Mass)
W80-00040

6D. Water Demand

WATER CONSERVATION AND ALTERNATIVE WATER SUPPLIES, PROCEEDINGS OF A SOUTHEAST REGIONAL CONFERENCE NOVEMBER 8-9, 1978 AT THE GEORGIA INSTITUTE OF TECHNOLOGY.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 269, Price codes: A10 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology, Atlanta. Report ERC 04-79 July 1979. 224 p. J.R. Wallace and B. Kahn, editors. OWRT B-123-NC(4) 2nd OWRT B-125-NC(4). 14-34-0001-9144, 14-34-0001-8134.

Descriptors: *Water conservation, *Water supply, Water demand, Water reuse, Water allocation.

The proceedings of the second in a series of conferences held by the water research institutes and water resources management agencies in the South Atlantic Gulf States are compiled. In this conference, present and emerging conflicts for available water supplies were described, alternative sources of water supply were examined, opportunities were considered for extending existing supplies, and courses of remedial action were recommended to assure adequate water supplies. Eighteen papers by separate authors review current and near-term water supply-demand problems in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia; discuss the President's water policy study; consider alternative water sources; and recommend approaches to more efficient water use in industry, agriculture, and municipalities.
W80-00001

FACTORS FOR PREDICTING COMMERCIAL WATER USE,
Metcalf and Eddy, Inc., Boston, MA.
J. R. Kim, and R. H. McCuen.
Water Resources Bulletin, Vol. 15, No. 4, p 1073-1080, August 1979. 3 tab, 1 equ, 3 ref. OWRT A-025-MD(4). 14-31-0001-5020.

Descriptors: *Water demand, *Water utilization, *Prediction, *Principal components analysis, Data collection, Multiple correlation analysis, Equations, Planning, Estimating, Methodology, Systems analysis, Mathematical models, *Commercial water use.

Growth in the commercial sector of the economy and the increased importance of total waste water volumes in design have created a need for methods of estimating commercial water demand. The results of a multiple correlation analysis and a principal components analysis suggest that commercial water demand is a function of the following three primary constructs: an employee water use factor, a customer layout factor, and a customer water facility factor. Three easily measured variables were used to represent these major constructs: gross store area, length of display windows, and the number of drinking fountains, respectively. Prediction equations relating water use and the three variables were derived and can be used by planners in estimating commercial water use. (Bell-Graf--Cornell)
W80-00203

6E. Water Law and Institutions

PROCEEDINGS, URBAN STORMWATER MANAGEMENT SEMINARS, ATLANTA, GEORGIA, NOVEMBER 4-6, 1975 AND DENVER, COLORADO, DECEMBER 2-4, 1975.
For primary bibliographic entry see Field 4A.
W80-00043

PLANNING TO NARROW THE IMPLEMENTATION GAP,
Municipality of Metropolitan Seattle-METRO, WA.
For primary bibliographic entry see Field 4A.
W80-00067

STATUS OF EPA'S EFFLUENT GUIDELINES FOR THE FOOD INDUSTRY,
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
J. D. Denit, and E. H. Forsht.
In: Proceedings of 8th National Symposium on Food Processing wastes, March 30-April 1, 1977, Seattle, Washington, p 9-19. 1977. 3 tab, 17 ref.

Descriptors: *Regulation, *Federal water pollution control act, *Food processing wastes, *Water reuse, Recycling, Legislation, Industrial wastes, Legal aspects.

The Environmental Protection Agency's promulgated regulations covering about 28,000 point sources within the food processing industry are discussed. The legal status of the regulations is reviewed, and food industry studies are reviewed. Legal issues include jurisdiction, and ranges of limitations for certain plants versus national uniform standards. Influences and constraints which may affect food processing regulation include the energy shortage and other environmental legislation. The requirements of the Federal Water Pollution Control Act Amendments (PL 92-500) and other environmental legislation have sparked interest in the recovery reuse, and conservation of process wastes and water. There is an increasing trend toward by-product recovery, reuse, recycle, and water conservation, along with end-of-pipe treatment. (See also W80-00116) (Small-FRC)
W80-00117

WATER QUALITY MANAGEMENT ACCOMPLISHMENTS COMPENDIUM I.
Environmental Protection Agency, Washington, DC. Water Planning Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 631, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-440/3-77-026, 1977. 117 p, 1 tab.

Descriptors: *Water quality control, *Administrative agencies, *Legal aspects, *Federal Water Pollution Control Act, *Local governments, Municipal wastes, Industrial wastes, Waste disposal, Regions, Waste water treatment, Waste water disposal.

Case studies of 58 programs in various states for water quality management, initiated under Section 208 of P.L. 92-500, are cited. The cases are categorized as either accomplishments, indicating formally adopted or implemented programs, or performance indicators, in which water quality management programs have received preliminary commitment but have not been implemented. The four major problem areas addressed by water quality agencies are nonpoint sources, on-lot disposal, industrial point sources, and municipal point sources of pollution. The case studies are cited by state and region of location. (Lisk-FRC)
W80-00242

ARIZONA GROUNDWATER LAW REFORM - AN URBAN PERSPECTIVE,
Arizona State Water and Sewer Dept., Tucson.
H. Holub.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, April 14-15, 1978, Flagstaff, Az., Vol. 8, p 16-25, 15 ref.

Descriptors: *Groundwater, *Water law, *Legal aspects, *Arizona, *Water management(Applied), *Urban hydrology, Constraints, Groundwater availability, Comprehensive planning, Political aspects.

Existing Arizona groundwater law, it is contended, does not provide for effective management of groundwater resources. Accordingly, several reforms are proposed to more effectively handle urban water problems under the present laws. These include: (1) a re-evaluation of existing preferences and subsidies which encourage the mining of groundwater, (2) an extraction tax to recognize public costs associated with groundwater mining and the need for replenishment, (3) a method of quantifying existing rights and measuring use of groundwater, (4) an effective system of management which considers differing types of water problems in various parts of the state, (5) a permanent mechanism to permit transfer of water rights away from specific parcels of land, and (6) a comprehensive set of regulations on groundwater use to enhance the public interest. The definitions of the problems, issues, goals and solutions of Arizona's water resource future are as diverse as are the interested parties. It follows therefore that the one problem which continues to stymie all attempts to solve the State's water resource problem is the unwillingness of the various competing interests to try seriously to work out a common solution. The failure to solve the problem, it is argued, increases the possibility of federal interventions in State water management. (Tickes-Arizona)
W80-00271

LEGAL ASPECTS OF URBAN RUNOFF DEVELOPMENT,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
D. A. Chudnoff.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Arizona, p 182-184, 9 ref.

Descriptors: *Legal aspects, *Legal review, *Water law, *Urban hydrology, *Urban runoff, Equitable apportionment, Competing uses, Water resources development, Constraints, Appropriation, Surface runoff, Developed waters, Planning.

The relationships between the separate disciplines of hydrology and law are analysed in this study into how water law and its strictures may impose upon the development of urban runoff in the metropolitan Tucson area. Brief descriptions of the doctrine of appropriation, diffuse surface waters and developed waters are presented to illustrate

the complexities of the problem of urban runoff development. It is suggested that planners must not only be aware of the legal issues involved but also must understand the philosophy and principles of water law. (Tickes-Arizona)
W80-00293

PEATLAND POLICY STUDY,
Minnesota Univ.-Duluth.
W. A. Fleischman.
Minnesota Department of Natural Resources, July, 1978. 98 p. 2 fig, 20 tab, 103 ref, 5 append.

Descriptors: *Peat, *Census, *Regulation, Wetlands, Production, Management, Marsh management, Legislation, Legal aspects, State governments.

The findings of this study are based on questionnaires mailed to the Natural Resource Department, State Geological Survey Director, and State Conservationist in each of the states and Puerto Rico. The study considers four major substantive areas related to peatland management: (1) peatland policies, (2) production, (3) future, and (4) peatland information and committee activity. The two major considerations regarding policy are the legal status of peatlands and the mechanisms for regulating peatlands. When given a specific and separate legal status, peat is often considered a mineral. The regulation of peatlands is based on a wide variety of legislative acts including surface mining laws, mining acts, wetland laws, mined land reclamation acts, environmental quality acts, and local zoning ordinances. The commercial operations producing peat are for the most part on private land. The peat that is extracted commercially in the peat production states includes peat of the major types: Sphagnum, reed sedge, and peat humus. Only eight states indicated that peat was a significant resource in that state. The major conclusion of the study is that peat management policy is in the early stages of development. (Steiner-Mass)
W80-00317

THE QUIET BEFORE THE SHOOTOUT OVER 'THE WATER LAW OF THE WEST',
D. Kirschten.
National Journal, Vol. 10, No. 4, p 149-53, January 28, 1978.

Descriptors: *Irrigation programs, *Federal project policy, *Political constraints, Water law, Political aspects, Irrigated land, Irrigation practices, Irrigation systems, Irrigation district, Federal-state water rights conflict.

The Carter Administration has proposed regulations that would limit the liberal water welfare benefits to western resident family farmers in accordance with the intent of the 1902 Reclamation Act. This vulnerable blueprint for western irrigation has been changed little by Congress since 1902. The Interior Department is under court order to prepare an environmental impact statement on the proposed rules, a process that will take at least a year. In a message to Congress, President Carter suggested that water pricing policies in the West encourage wasteful consumption. He cited a study showing that over half of the water delivered through Bureau of Reclamation irrigation systems is completely wasted. The President's answer is wise management and conservation, not expensive new water projects. A federal court has ordered the Administration to address the family farming mandates of the reclamation law. Only Congressional action can change that law. Carter has managed to elevate the water pojects issue from a matter of parochial politics to one of national concern. The President's basic question on the economics and equities of public financing of water projects has yet to be answered. (Coffey-Florida)
W80-00360

PRELIMINARY ANALYSIS OF LEGAL OBSTACLES AND INCENTIVES TO THE DEVELOPMENT OF LOW-HEAD HYDROELECTRIC POWER IN THE NORTHEASTERN UNITED STATES,
Franklin Pierce Law Center, Concord, NH.
P. W. Brown, and A. W. Buxton.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE/RA-23-216.00.0-01, Price codes: A05 in paper copy, A01 in microfiche. Report DOE/RA-23-216.00.0-01, Sept. 1978 (Revised March 1979), 75 p.

Descriptors: *Damsites, Hydroelectric plants, *Hydroelectric project licensing, Dams, Federal jurisdiction, State jurisdiction, Energy, Legal aspects, Regulation, Regional analysis.

The statutes and case law of 19 states and the Federal Government which affect developers of small dams are analyzed. The legal uncertainty and regulatory burdens which confront the developer are reported. For ease of analysis, the mythical state of Hydrovania is described. Hydrovania represents many of the common features of all the states under study. No final conclusion is reached concerning the nature of impact of any particular law or doctrine on small dam developers. Regional approaches and solutions to the problem of increasing the rate of small dam development will have some success. Experiments in one state will bear useful information for activities in another state. Other problems, to be examined in subsequent reports, and not discussed here include: (1) the institutional obstacles and incentives to small dam development; (2) the access to capital and capital markets by developers; and (3) the relationship between dam owners and riparian owners. There is a flow diagram illustrating federal regulation of small dams. (Coffey-Florida)
W80-00363

THE ROLE OF THE PERMIT SYSTEM IN THE CALIFORNIA COASTAL STRATEGY,
R. G. Healy.
In: Protecting the Golden Shore (Lessons from the California Coastal Commissions), Healy, R.G., ed., p 67-95, The Conservation Foundation, Washington, D.C., 1978.

Descriptors: *California, *Coasts, *Permits, *Land use, Planning, Resource allocation, Building codes, Water policy.

How the permit system, as originally conceived and later administered, influenced California's final objective of feasible coastal plan is discussed. The permit process set out in Proposition 20 was not meant to be the final step, but the first of three phases: (1) a four-year interim permit system; (2) the preparation of a coastal plan; and (3) the acceptance of a plan by the state legislature. As designed by the coastal initiative's authors, the permit process was to have a complex relationship to the other two phases. First, the state commissions were to use permit authority to protect coastal resources during the interim period while the plan was being prepared. Second, the process would provide information on coastal issues and possible policies, resulting in a better plan. Third, the permit process would generate interest and support for legislative adoption of a permanent system of coastal controls. How well the integration of the permit process and planning worked in reaching each of these three objectives is discussed. On balance, California's strategy was a highly successful one. (Coffey-Florida)
W80-00364

THE COASTAL COMMISSIONS AND STATE AGENCIES: CONFLICT AND COOPERATION,
J. S. Banta.
In: Protecting the Golden Shore (Lessons from the California Coastal Commissions), Healy, R.G., ed., p 97-131, the Conservation Foundation, Washington, DC, 1978.

Descriptors: *California, *Coasts, *Permit, *Land use, Planning, Regulation, Environmental control, Resources, Governments, Water law, Legislation, Coastal engineering.

The passage of Proposition 20 proved overwhelming that most Californians did not believe that existing state and local actions regarding pollution, the park system, and land-use planning were adequately protecting coastal values. The initiative gave the California coastal commissions a clear directive. They had final and near-absolute authority over the location and type of development near the coast. The commissions could prohibit a proposed development or impose strict conditions, even though the project had previously received other state or local approvals to begin construction. Even when a state agency was the developer, as in highway projects, it too was required to secure a permit from the coastal commissions. An extensive overview is presented of the California coastal commissions and how they worked. The coastal commissions were an emergency response to bureaucratically confused environmental priorities. The most significant institutional impact of the commissions was to cause state agencies to see the coast as a geographic entity, rather than simply in terms of their own functions. Alternatives to the commission approach are discussed. (Coffey-Florida)
W80-00365

THE ANGLO-FRENCH CONTINENTAL SHELF CASE,
University of Wales Inst. of Science and Technology, Cardiff.
E. D. Brown.
San Diego Law Review, Vol. 16, No. 3, p 461-530, 1979.

Descriptors: *International law, *Continental shelf, *Boundary disputes, Judicial decisions, International arbitration, United Nations, Geneva convention, Law of the sea, Legal aspects, Regulation, Governments.

The longstanding dispute between France and England over the delimitation of their respective continental shelves was recently put to a court of arbitration. The Court's holding, the boundary lines laid down by the Court and the impact of that decision are discussed. The dispute is only the second continental shelf boundary question settled in a judicial arena, and the first involving parties to the Geneva Convention on the Continental Shelf. For these reasons, the case will be carefully scrutinized by those involved in similar disputes. Canada and the United States are in disagreement over the boundaries in the Gulf of Maine. The Third United Nations Conference on the Law of the Sea could render the court's decision of only transitional importance, if the Conference delivers a clear, workable formula for the delimitation of the continental shelf between neighboring states. (MacGregor-Florida)
W80-00366

FRESHWATER AND THE FLORIDA COAST: SOUTHWEST FLORIDA.
Proceedings of a Seminar for the Southwest Florida Water Management District, May 26-27, 1977, Tampa, Florida, Sea Grant College Program Report Number 22, Southwest Florida Water Management District, Brooksville, Report No. 1977-1, Oct 1977. 244 p, 3 append.

Descriptors: *Estuaries, *Freshwater, *Water management(Applied), *Southwest Florida Water Management District, Water policy, Water utilization, Water districts, Water resources, Water supply, Economics, Ecosystems, Environmental engineering, Estuarine environment, Estuarine fisheries.

Freshwater use in the Southwest Florida Water Management District is analyzed from economic, engineering and biological perspectives. The papers include: (1) The Coastal Zone: Multi-Use Resource Allocation and Institutional Failure; (2) Economics of Water Problems; (3) Development and the Hydrology and Geohydrology of Coastal Drainage Basins; (4) A Review and Evaluation of Selected Numerical Models for Coastal Zone Water Management; (5) Freshwater and the Florida Coast: Review and Update; (6) Groundwater Flow; (7) The Marine Ecosystem From an Engineering Viewpoint; (8) The Role of Freshwater in an Estuary; (9) The Estuary - What's It to You; (10) The Estuary Viewed as a Dynamic System; and (11) Some Relationships between River Flow,

Estuarine Characteristics, and Economics in a Florida Gulf Coast Region. Bibliographies are included. (MacGregor-Florida)
W80-00367

INTERNATIONAL ENVIRONMENTAL IMPLICATIONS OF SOVIET DEVELOPMENT OF THE VOLGA RIVER,
Western Michigan Univ., Kalamazoo.
P. P. Micklin.
Human Ecology, Vol. 5, No. 2, p 113-135, June 1977.

Descriptors: *River basin development, *River regulation, *International law, River flow, Environmental effects, International commissions, United Nations, Water allocation(Policy), Legal aspects, Water supply.

Hydrological alteration of major rivers may cause international environmental disturbance. The development of the Volga River by the Soviet Union is used to illustrate the problem. The most immediate victim of Volga development is Iran, which borders on the Caspian Sea. The Volga, a tributary of the sea, has had its natural flow changed by the development. This change has damaged the Caspian and thereby Iran. Proposed plans to alleviate problems in the Caspian Sea would clearly have global effects. The international problems associated with Soviet development of the Volga are not unique, and concern all governments. An American example is the use of the Colorado River by the United States to the detriment of Mexico. Suggested solutions include: (1) an 'international environmental impact statement' modeled on the provisions of the United States National Environmental Policy Act; (2) an International Environmental Agency; and (3) involvement of United Nation's organizations. (MacGregor-Florida)
W80-00368

LOCAL GOVERNMENT RESPONSE TO STATE-MANDATED LAND USE LAWS,
Oregon State Univ. Corvallis.
B. A. Weber, and K. S. Peroff.
Journal of the American Institute of Planners, Vol. 43, No. 4, p 352-60, October 1977.

Descriptors: *Wisconsin, *Shore protection, *Land use, Shores, Coasts, Zoning, Regulation, Local governments, Legal aspects, Land management.

In 1966, the Wisconsin legislature passed one of the nation's first Water Resources Acts. The shore land provisions of the Act and the effect they had on county governments are discussed. The Act required counties to enact a land use control package for shore land. The package included zoning, dredge and fill regulations, and standards for wells and septic tanks. County regulations were required to meet or exceed the minimum standards of the package. An important aspect of the Act was the elimination of a town's veto power over county shore land zoning. The Act's shore land provisions have spurred counties to institute control over all use of unincorporated land, whether or not it borders on water. (MacGregor-Florida)
W80-00369

COASTAL HAZARDS AND NATIONAL POLICY: A JURY-RIG APPROACH,
Massachusetts Univ., Amherst.
R. H. Platt.
Journal of the American Institute of Planners, Vol. 44, No. 2, p 170-80, April 1978.

Descriptors: *Coastal zone management, *Flood plain insurance, *Flood plain zoning, Administrative agencies, Coastal structures, Coasts, Regulation, Executive orders, Flood forecasting, Flood control, National seashores.

Nearly half of the people in the United States live in counties which border on a shoreline. They are subjected to a variety of coastal hazards, most notably, hurricanes, floods and erosion. Despite these dangers, the federal government lacks a unified policy in this area. Some specific elements of the 1972 Coastal Zone Management Act (CZM) which necessitate consideration of natural hazards are: (1) delineation of coastal zones; (2) permissible land and water uses; (3) areas of particular concern; and (4) state management techniques. The Act lacks substantive standards. Key aspects of the National Flood Insurance Program (NFIP) relevant to coastal zone management are: (1) mapping; (2) coastal high hazard areas; (3) erosion; and (4) permits. The NFIP contains specific national objectives and has begun to achieve favorable results, although it is complicated, unwieldy and controversial. Some helpful executive orders are examined. Two recent ones issued by President Carter provide a detailed policy which, when combined with the CZM and NFIP, will provide a national policy for coastal zone hazard management. (MacGregor-Florida)
W80-00370

ALASKA NATIVE WATER RIGHTS AS AFFECTED BY THE ALASKA NATIVE CLAIMS SETTLEMENT ACT,
K. Stoebner, V. Camerino, and S. Nickeson.
American Indian Journal, Vol. 4, No. 3, p 2-26, March 1978. 3 append.

Descriptors: *Alaska, *Indian reservations, *Water rights, Indians, Federal government, Judicial decisions, Water utilization, Water supply, Water allocation(Policy), Riparian rights, Prior appropriation.

While water is relatively abundant in Alaska, there are problems of quality, distribution, and the important question of the water rights of the Alaskan Indians. The importance of water to the Alaska natives and the effect of the Alaska Native Claims Settlement Act (ANCSA) has had on the water rights of these people are discussed. The problem of defining native water rights into one of at least three possible categories - riparian, prior appropriation, or federal reserve rights - is examined. The potential importance of an upcoming native water rights case, Paug-Vik v. Guy Martin, the Alaskan Water Use Act and the National Interest Lands Bill is considered. The question of native water rights needs quick and final resolution. Competition for water resources can only increase as the commercial development of Alaska continues. A strong legal claim exists for retained Native water rights on Native selected lands. Water rights are critical to the maintenance of Native subsistence economics and continued commercial developments. (MacGregor-Florida)
W80-00371

RESPONSE TO GAO WATER REPORT.
American Indian Journal, Vol. 4, No. 8, p 40-45, August 1978.

Descriptors: *Indian reservations, *Water rights, *Federal reservations, Administrative agencies, Legislation, Water supply, Water resources, Federal government, Water allocation(Policy), Legal aspects, Water conservation.

The Government Accounting Office (GAO) has issued a report entitled 'Water Rights Reserved for Federal and Indian Reservations: A Growing Controversy in Need of Resolution.' This is a summary of responsive reports by the National Congress of American Indians and the Colville Confederated Tribes. Omissions and inaccuracies in the GAO document are divulged. The GAO conclusions place the burden of loss on the Indian tribes without recognizing the federal government's responsibility for water problems in the western reservations. The GAO report also ignores Indian rights to compensation under the Fifth Amendment for water rights lost by government action. Ten recommendations are given, by the Congress, chief of which is that the GAO report not be issued. The Colville summary sees greed and corruption as the reason for Indian reliquishment of their water rights. The Colville report seeks judicial rather than legislative answers to their water rights problems. Colville also recommends non-issuance of the GAO report. (MacGregor-Florida)
W80-00372

NCAI TO GAO: LEGISLATIVE QUANTIFICATION OF INDIAN WATER RIGHTS IS NOT THE ANSWER.
American Indian Journal, Vol. 5, No. 1, p 33-36, January 1979.

Descriptors: *Indians, *Water rights, *Indian reservations, State governments, Water policy, Administrative agencies, Water supply, Federal reservations, Water demand, Water resources, Legal aspects.

This is the National Congress of American Indians' response to the Government Accounting Office's report to Congress, and Indian Reservations: A Growing Controversy in Need of Resolution. Native Americans have been continually forced to defend their land and water from white appropriation for development purposes. The GAO report presumes the major problem with western water supply is the unquantified nature of the federal and the Indian reserved rights. The real problem is there is very little water in the West, and non-Indian interests are unwilling to establish any ceiling on their water use. The development of western non-Indian water uses in complete disregard of known Indian tribes water rights claims constitutes a callous and inexcusable breach of fiduciary duties by the trustee, United States. The GAO conclusions place the burden of compromise and loss upon Indian tribes. The GAO report is so incomplete and inadequate that the Comptroller General should be requested not to publish it. Recommendations regarding western water policy and Indian reserved rights should be considered. (Ewing-Florida)
W80-00373

NCAI'S EXECUTIVE COUNCIL MEETING AND INDIAN WATER RIGHTS.
American Indian Journal, Vol. 5, No. 2, p 35-38, February, 1979.

Descriptors: *Water rights, *Indians, *Indian reservations, Water policy, Federal government, Water resources, Constitutional law, Federal budget, Legal aspects, Water law, Federal reservations.

Recent federal actions pressuring or threatening to pressure Indians to quantify their water rights were discussed. The National Congress of American Indians (NCAI) stated that Indian rights to use of water are invaluable interests in real property; full equitable title to which resides in the tribes. The rights are private in character and protected against violation by the Fifth Amendment. It is the obligation of the United States government, as trustee, to rigorously adhere to the distinction between Indian and federal rights. The tribes have the full authority to administer, control and allocate the water resources on their reservations. The NCAI also adopted resolutions pertaining to: (1) required consent of tribes on all federal actions affecting Indian water rights; (2) funding for consultation with tribes and employment of Indian counsel; (3) development of criteria for land classification; (4) successors to Indian lands; (5) amendment of the McCarran amendment; (6) Indian water projects; (7) United States vs. tribes; (8) tribal participation in governmental water law commissions; and (9) no quantification of Indian rights. (Ewing-Florida)
W80-00374

WHO WILL REAP THE MINERAL RICHES OF THE DEEP,
S. G. Slappey.
Nation's Business, Vol. 66, p 24-28, 32, March, 1978.

Descriptors: *International law, *International waters, *Resources development, United Nations, Natural resources, Mineral industry, Foreign countries, Mining, Water policy, Beds under water, Environmental effects.

There is an area of the Pacific between Hawaii and Mexico, approximately 2600 miles long and 800 miles wide, where the sea bed has billions of ore-rich nodules. For centuries, the world has recog-

ized freedom of the seas beyond national limits. lowever, the United Nations (U.N.) Conference n the Law of the Sea has been the stage for ternational controversy over seabed mining ghts since the mid-1960's. Many U.N. delegates ant inter-nation ownership and control of the abed resources outside territorial waters. They so want private mining companies to pay for ining operations and to take only a small percentge of the profits after the minerals are marketed. elegates have also demanded the formation of an ternational seabed authority with its own enrcement fleet. No precedent exists for such a rce. America must reach for the nodules, as a rge percentage of the ore involved are currently ported. Congress is still trying to formulate a bill at will please companies, consortia, liberal conessmen, and President Carter. (Ewing-Florida) 80-00375

ATER RIGHTS: THE ISSUE AND THE OURTS,
. Anderson.
kwesasne Notes, Vol. 9, No. 4, p 28-29, Septemr 1977.

escriptors: *Federal reservations, *Indian reservations, *Indians, *Water rights, Water supply, ater policy, Judicial decisions, Water law, Water sources, Federal government, Federal-state ater rights conflict, Constitutional Law.

atural resources, including water are becoming portant and prominent political, cultural, and gal issues, especially in the western states where ater means the difference between arible land and sert. Indian water rights are based primarily on is concept: when the federal government created dian reservations and when it added to them, it served the use of enough water to irrigate the rigable portions of the reserved land. The Indian ater right is based on the date the reservation as set aside for Indian use, either by treaty, act of ongress, or by executive order. Problems arise in termining which water sources were reserved. hese problems become more serious as water sources are put to full use. A history of court cisions has left the Indian people with water ghts. Today, Indian nations are increasingly ting to secure their rights. This means utilizing e water in their territories. These rights are beming increasingly controversial and political as e needs of urban centers and industry intensify. ith historical momentum and contemporary and ure political realities on a collision course, the ater battle will be a primary issue. (Ewing-Flor-a)
80-00376

LTERNATIVE REGIMES FOR THE OCEAN,
Brown, N. W. Cornell, L. L. Fabian, and E. B. eiss.
Regimes for the Ocean, Outer Space, and eather, p 19-34, The Brookings Institute, Washgton, D.C., 1977.

escriptors: *Law of the sea, *Oceans, *Regime, nternational law, Resources development, Natu resources, Exploitation, Oil, Natural gas, Exoration, International waters.

cent and prospective developments affecting the ean are severely undercutting the previous mari-e order. The old order was based largely on nciples of open access to and free use of the ters beyond the narrow territorial seas. It is now nerally accepted that the open access regime ll not and should not continue through the 70's. This is the premise of the Third United tions Law of the Sea Conference, which conned in 1973. The nature of the successor regime still unclear. The basic technological and social ces affecting man's perspectives on the ocean discussed. The topics covered include: (1) the volution in marine technology; (2) the rise of ological consciousness; (3) the new economics of ean resources scarcity; (4) the new demands for ernational income redistribution; (5) the new ean politics; (6) open access and free use of the eans; and (7) national and international manage-nt of the oceans. Alternative regimes for ocean management are discussed at length. (Coffey-Florida)
W80-00377

THE MANAGEMENTAL FISHERIES,
S. Brown, N. W. Cornell, L. L. Fabian, and E. B. Weiss.
In: Regimes For The Ocean, Outer Space and Weather, p 50-62, The Brookings Institute, Washington, D.C. 1977.

Descriptors: *Law of the sea, *Fish management, *International law, Fish farming, Fish conservation, Fish harvest, Fish migration, Fish populations, Fish stocking, International commissions, International waters.

Worldwide, many fish stocks are either already overfished or are threatened with depletion. In response to this threat, some countries have established regional fishery commissions and have entered into agreements to follow certain rules for stock conservation. These multilateral agreements are only minor variants of the basic international regime of open access and freedom to fish, which means that property rights to a fish are established by capture. In other regions of the world, the prevailing response to emerging fish scarcities has been unilateral extension of national fishing jurisdictions. The Law of the Sea Conference is likely to endorse wide coastal fishing zones. The extension of national control fails to deal with the transnational mobility of some fish stocks and the interdependence of species. An extensive analysis of the sources of and possible remedies to the growing problem of overfishing is presented. The ineffectiveness of both the national and multinational approaches is demonstrated. More extensive and intensive international management is needed. (Coffey-Florida)
W80-00378

OFFSHORE OIL AND GAS EXPLOITATION,
S. Brown, N. W. Cornell, L. L. Fabian, and E. B. Weiss.
In: Regimes for the Ocean, Outer Space and Weather, p 63-72, The Brookings Institute, Washington, D.C., 1977.

Descriptors: *Oil, *Natural gas, *Law of the sea, *International law, Federal jurisdiction, Exploration, Offshore platforms, Oil pollution, Oil reservoirs, Continental shelf, Energy, Political constraints.

The exploration for oil and gas at progressively greater depths and offshore distances has been an important catalyst to the revision of the traditional open access law of the sea. Revisions have been mainly in the form of unilateral extensions of national jurisdiction by coastal states over all petroleum resources in their adjacent continental shelves. As more countries assert such jurisdiction the inadequacy of the unilateral approach becomes more evident, for many potential hydrocarbon deposits lie in areas claimed by several states. The many developing problems created by increased international exploitation of the world's ocean deposits of hydrocarbons are examined. Some of the issues discussed include: (1) the extent and distribution of the ocean's hydrocarbon resources; (2) the problems of jurisdiction and allocation; (3) the conflicts with other ocean uses; and (4) the requirements of effective management. Effective management requires a combination of efficient exploitation of resources, minimizing the potential for dangerous international conflict, and due consideration of other user's rights and the condition of the sea. (Coffey-Florida)
W80-00379

AIR AND WATER POLLUTION POLICY,
Resources for the Future, Inc., Washington, DC.
Fellow Quality of the Environment Div.
A. M. Freeman.
In: Current Issues in U.S. Environmental Policy, p 12-67, The John Hopkins University Press, Baltimore, Maryland, 1978.

Descriptors: *Clean Air Act, *Federal Water Pollution Control Act, *Water quality standards, *Water quality control, Air pollution, Water pollution, Legislation, Air environment, Cleaning, Regulations, Federal government, Water law.

Between 1970 and 1972, Congress passed two major pieces of legislation that established air and water pollution control strategies for the 1970's. These were the 1970 Clean Air Amendments (CAA) and the 1972 Federal Water Pollution Control Amendments (FWPCA). They established new goals and standards for air and water quality, set deadlines for clean-up actions, and created new procedures and mechanisms for regulation and enforcement. Those portions of the CAA and FWPCA dealing with stationary sources are examined. Such an examination might prove helpful in assessing recent and proposed changes in our basic air and water pollution control laws. No attempt is made at a complete evaluation of existing policies or at definitive judgment concerning their effectiveness. Some of the major problems that have emerged during efforts to implement the CAA are identified and examined from an economic perspective. Some proposed changes in policy are suggested. (Coffey-Florida)
W80-00380

REPORT TO THE CONGRESS ON OCEAN POLLUTION OVER FISHING, AND OFFSHORE DEVELOPMENT (OCTOBER 1976 THROUGH SEPTEMBER 1977).
Department of Commerce, Washington, DC.
Annual Report to Congress, National Oceanic and Atmosphere Admin., Dept. of Commerce, November 1978, 49 p, 7 tab, 3 fig.

Descriptors: *Oceans, *Marine fisheries, *Water pollution control, Mining, Management, Oil pollution, Oil wells, Natural gas, Alaska, Environment, Fish populations.

The findings of programs developed in response to Section 202, Title II, of the 1972 Marine Protection, Research, and Sanctuaries Act are summarized. Long-term effects research carried out by the National Oceanic and Atmospheric Administration (NOAA) in fiscal year 1977 emphasized petroleum hydrocarbons, heavy metals, fishery stock assessments, ocean mining, and oil and gas development on the Alaskan Outer Continental Shelf. These investigations provide the data and information required to make more definitive evaluations of the effects of human activities on the ocean environment. Included are many illustrative tables, charts, and maps. There are three chapters: (1) Ocean Pollution; (2) Overfishing, and (3) Offshore Development and the Ocean Environment. Chapter (1) includes findings on the effect of petroleum hydrocarbons and heavy metals on marine organisms. Chapter (2) covers Northwest Atlantic fisheries and related federal legislation. Chapter (3) discusses ocean mining and the Outer Continental Shelf Environmental Assessment Program. (Coffey-Florida)
W80-00381

OBTAINING ACCESS TO SOLAR ENERGY: NUISANCE, WATER RIGHTS, AND ZONING ADMINISTRATION,
C. Polis.
Brooklyn Law Review, Vol. 45, No. 2, p 357-90, Winter 1979.

Descriptors: *Riparian rights, *Solar radiation, *Prior appropriation, Water law, Water rights, Radiation, Easements, Zoning, Energy, Resources development.

The energy crisis has intensified legislative interest in alternative energy sources and has triggered renewed legal interest in the means of obtaining access to these sources. Solar energy has been a focal point of attention. The use of easement law is ineffective as a means of securing solar energy. New applications of nuisance law, water rights concepts, and zoning administration will guarantee access to solar energy. Streams of light may be analogyzed to surface water courses. Rights to both attach to the flow and not the corpus. A right in water is defined by use rather than by possession. Because of the analogous nature of solar

energy, the entitlement to solar energy may also be defined in terms of use. The same principles that govern water law can be applied to solar resources. Included are sections on: riparian water rights, and rural solar rights, and prior appropriation water law and urban solar rights. Once the entitlement to solar access is judicially recognized, the issue of who will receive the entitlement must be resolved. Water law may serve as a model for that determination. (Coffey-Florida)
W80-00382

SEA CHANGES AND THE AMERICAN REPUBLIC,
Georgia Univ., Athens.
D. Rusk, and M. S. Ball.
Georgia Journal of International and Comparative Law, Vol. 9, No. 1, p 1-19, 1979.

Descriptors: *Law of the sea, *Federal-state water rights conflicts, *Continental shelf, Coasts, Water law, Federal government, State governments, Federal jurisdiction, Legislation, United Nations, International law.

Major changes in the law of the sea are near. Past treaties have failed to resolve the issues of the breadth of territorial seas and the outer limits of the continental shelf. Changes in the international law of the sea will have a profound effect on the internal arrangements of the United States. Questions will arise concerning the sharing of responsibilities between federal and state governments. These should be considered now rather than later resolved as an impulsive reaction to the changing world situation. While federal and state governments each recognize the legitimate interest of the other in the sea, there has been no ordering of federal-state relation in the marine resources governance. The United States should consider extending its territorial sea from three to twelve miles. Preliminary debate on and implementation of a territorial sea change would provide a context for re-thinking federal-state relations, for development of a comprehensive oceans policy, and for meaningful public participation. (Vloedman-Florida)
W80-00383

RE-USE OF FOREIGN WATERS,
W. H. Fischer.
Colorado Lawyer, Vol. 7, No. 4, p 522-35, 1978.

Descriptors: *Colorado, *California, *Water reuse, *Foreign water, Imported water, Water rights, Water policy, Appropriation, Water law, Water importing, Water users.

As to the relative rights of appropriators of water imported into the South Platte River and the developer of those waters, the Colorado Supreme Court has definitively pronounced that the developer (1) may re-use; (2) may make successive use of; and (3) after use, may make disposition of imported water. A vital question remains: where an importer of water has, after its use, discharged the unconsumed water into the natural streams of the state from which it has been appropriated by other, may the importer thereafter recapture it from the stream. The tendencies of the Colorado and California court rulings indicate that re-use is an attractive, even popular concept. However, the concept of re-use abandonment, or loss of the right to make a re-use or a succession of uses of foreign water, should be rejected in spite of compelling arguments in its favor. (Corey-Florida)
W80-00384

PLANNING CONSIDERATIONS FOR PRESERVATION AND USE OF THE NATIONAL SEASHORES,
National Park Service, Denver, CO.
A. H. Robinson.
Coastal Zone Management Journal, Vol. 5, No. 1/2, p 5-34, 1979. 2 tab, 4 fig.

Descriptors: *National parks, *National seashores, *Planning, *Preservation, Environmental effects, Parks, Barrier islands, Seashores, Conservation, Waterfowl, Coasts.

The historical development of the 'national seashore' national parks and the evolution of basic planning and management policies applied to these areas are reviewed. Some common planning issues in the national seashores include: (1) zoning problems for natural, historic, development and special-use zones; (2) carrying capacity; (3) transportation and access modes; (4) land ownership and legal jurisdiction over submerged lands, eroding boundaries, fast lands, extended tenancies on private lands, and shared administrations; and (5) traditional resource use problems like sport and commercial fishing, hunting and oversand vehicle use. The future of the national seashores and barrier island conservation and development and the future role of federal agencies and private organizations are discussed. Included are 120 references and several tables, charts and maps. (Coffey-Florida)
W80-00385

PLANNING FOR ENVIRONMENTAL MANAGEMENT: NEW DIRECTIONS AND INITIATIVES,
Research Group, Inc., Atlanta, GA.
L. F. Dean.
Coastal Zone Management Journal, Vol. 5, No. 4, p 285-306, 1979. 3 tab.

Descriptors: *Environmental control, *Water quality control, *Water management(Applied), Planning, Programs, Coasts, Water quality, Federal government, Regulation, Water uses, Land use.

Environmental management planning is an emerging professional discipline characterized by a new set of implementation tools. The direction of environmental management planning is identified. Two federally funded programs are reviewed: the Coastal Zone Management Program (CZM) under the United States Commerce Department and the '208' Areawide Water Quality Management Planning Program ('208') under the federal Environment Protection Agency. The CZM and '208' plans and programs, expected to receive federal agency approval during 1977-1978, and CZM and '208' legislation form the basis for the comparison. Several tables are included for comparison analysis. Some of the topics covered include: (1) legislative comparison; (2) designation of lead agency for program development; (3) program requirements for land and water use regulation; (4) new program implementation approaches included in the legislation; (5) analysis of methods for program implementation; (6) legal authority; (7) inter agency coordination; and (8) key findings on the future directions for environmental management planning. The implementation methods being used by the two programs have a number of similarities. (Coffey-Florida)
W80-00386

COMPENSATING STATES AND THE FEDERAL GOVERNMENT FOR DAMAGES TO NATURAL RESOURCES RESULTING FROM OIL SPILLS,
National Advisory Committee on Oceans and Atmosphere, Washington, DC.
J. S. Mattson.
Coastal Zone Management Journal, Vol. 5, No. 4, p 307-32, 1979. 2 tab.

Descriptors: *Replacement costs, *Clean Water Act, *Oil spills, Oil pollution, Ecosystems, Compensation, Damages, Oceans, Beaches, Taxes.

An unsatisfactory system of assessing damages from careless management of energy resources is developing. The replacement cost concept satisfies courts but does not reflect the real value of ecosystem damage. Compensation issues are examined in light of existing common law schemes such as nuisance and pending statutory plans such as 'Superfund.' The five types of ecological damage from oil spills are: human food contamination, decrease of fisheries resources or damage to wildlife, loss of esthetic values by oiling of beaches, modification of marine ecosystems diversity and productivity, and habitat modification affecting recolonization. Superfund, proposed by section 311 of the Clean Water Act, works to eliminate the inequities of oil pollution costs. It involves a $200 million, self-replenishing compensation fund supported by a three-cent per barrel tax on crude oil. Superfund's basic premire is to spread the cost of oil spills over the entire energy using population, while leaving the individual spillers at a disadvantage to the extent that they cannot pass on the costs. (Corey-Florida)
W80-00387

GEOTHERMAL ENERGY: PROBLEMS AND SHORTCOMINGS OF CLASSIFICATION OF A UNIQUE RESOURCE-A LOOK AT PROBLEMS WITH WATER LAW, WITH PARTICULAR EMPHASIS ON NEW MEXICO,
R. M. Silver, and S. P. Comeau.
Natural Resources Journal, Vol. 19, No. 2, p 445-59, April 1979.

Descriptors: *New Mexico, *Geothermal studies, *Energy, Mineral industry, Heated water, State jurisdiction, Natural resources, Water rights, Classification, Legal aspects.

Geothermal energy, a unique natural resource difficult to legally classify as mineral or water, creates complex legal issues. The essence of the resource's value is its pure heat energy. The resource is literally the earth's natural heat but statutory definitions include many by - products. The classification of geothermal resources will have far-reaching effects on the legal treatment of the resource and on its economic potential for development. States with the most lucid, explicit, and comprehensive laws in the area will benefit most from the resource, encouraging development of a relatively efficient and environmentally sound form of energy production. Even after some type of classification is attempted, two questions remain unclear: ownership by the mineral users versus surface estate holders and jurisdiction over the resource. Under New Mexico's geothermal laws, whatever the final classification of the resource, any water involved must be treated separately from the mineral. This would allow several approaches of dealing with geothermal water, depending on whether water in a geothermal formation is depletable and non-tributary or connected to a state's natural tributary water system. (Corey-Florida)
W80-00388

CONTROLS AND REMEDIES FOR GROUND WATER - CAUSED LAND SUBSIDENCE,
J. Teutsch.
Houston Law Review, Vol. 16, No. 2, p 283-331, 1979.

Descriptors: *Texas, *Subsidence, *Ground water, *Water management(Applied), Judicial decisions, Common law, Absolute ownership doctrine, Underground water conservation, Regional water management, Administrative agencies, Legislation.

Ground water is a valuable resource in the Houston-Galveston region of Texas, but unrestrained withdrawal has caused land surface subsidence. Tort actions and administrative regulation are legal tools for solving the problem. Two legal aspects are reviewed: the general common law on ground water and the 'absolute ownership' rule of the Texas Supreme Court which is that the owner of surface lands owns all water flowing beneath the surface. The Texas court has recently modified the rule to allow damages to one injured by subsidence from ground water pumpage negligently conducted by a neighboring property owner. Management of the subsidence problem is better suited to agency regulations. The legislatively established Harris-Galveston Coastal Subsidence District has had some success in dealing with the problem. The Districts' authority is too geographically narrow for two reasons: it covers only two counties and not the entire affected area and substantively no authority exists for it to provide surface water alternatives to ground water withdrawals. (MacGregor-Florida)
W80-00389

THE LAW OF THE SEA: A REJOINDER TO RICHARD G. DARMAN,
Pittsburg Univ., PA.

D. S. Cheever.
Foreign Affairs, Vol. 56, No. 3, p 660-65, April 1978.

Descriptors: *International law, *International waters, Water rights, Water policy, United Nations, Mining treaties, Natural resources, Legal aspects, Foreign countries, Beds under water.

In January 1978, Richard J. Darman advocated rethinking United States interests in achieving a comprehensive agreement at the Law of the Sea Conference. Darman's argument relied heavily on five critical judgments concerning the present state of the Informal Composite Negotiating Text. Each of these judgments is erroneous. There is a substantial chance that the Conference will not produce a draft acceptable to the U.S. delegation. The best U.S. fallback position in that event would be to pursue the possibility of wide acceptance of a partial treaty. The treaty might embody agreed general principles concerning the seabed, without addressing the difficult problems of control and governance. These would be left to a future Conference, with the corollary that the U.S. would slow down its effort to embark on deep seabed mining operations. The partial treaty as contrasted with the proposal mini-treaty would build on areas of agreement rather than disagreement. It would bypass the Conferences principle roadblock, the International Seabed Authority. A mini-treaty, dealing solely with access rights to seabed minerals, would jeopardize a wide agreement on an ocean regime that has already been achieved. (Ewing-Florida)
W80-00390

6F. Nonstructural Alternatives

LOCAL GOVERNMENT RESPONSE TO STATE-MANDATED LAND USE LAWS,
Oregon State Univ. Corvallis.
For primary bibliographic entry see Field 6E.
W80-00369

6G. Ecologic Impact Of Water Development

STREAM CHANNEL MODIFICATION IN HAWAII. PART A: STATEWIDE INVENTORY OF STREAMS: HABITAT FACTORS AND ASSOCIATED BIOTA,
Hawaii Cooperative Fishery Research Unit, Honolulu.
A. S. Timbol, and J. A. Maciolek.
U.S. Fish and Wildlife Service, Office of Biological Services, Report FWS/OBS-78/16. April, 1978. 157 p. 16 fig, 16 tab, 40 ref, 3 append.

Descriptors: *Hawaii, *Census, *Stream improvement, *Ecological effects, *Aquatic habitat, Streams, Channel improvement, Stream stabilization, Perennial streams, Fish, Biomass.

There are at least 366 perennial streams in the five largest islands of Hawaii. Fifteen percent of these streams have been altered. Six types of channel alteration have been identified: lined channel, channel realignment and riparian clearance, elevated culvert, revetment, filled-in channel, and extended culvert. A total of 151 km of these modifications has been identified. On the basis of other human disturbances, only 14% of Hawaiian streams may be physically pristine, and none of these is on Oahu, the most populous island in the state. There are apparently no longer any biologically pristine streams, since at least one exotic species was found in all streams sampled. Only 27% are of high ecological quality (pristine-preservation use), and none of these high ecological quality streams is on Oahu. Both in numbers and biomass, native fish and decapod crustacean species are dominant in most altered streams. Water is exported from 53% of all perennial Hawaiian streams. (See also W80-00004) (Steiner-Mass)
W80-00003

STREAM CHANNEL MODIFICATION IN HAWAII. PART B: EFFECT OF CHANNELIZATION ON THE DISTRIBUTION AND ABUNDANCE OF FAUNA IN SELECTED STREAMS,
Hawaii Cooperative Fishery Research Unit, Honolulu.
S. E. Norton, A. S. Timbol, and J. D. Parrish.
U.S. Fish and Wildlife Service, Office of Biological Services. Report FWS/OBS-78/17. May, 1978. 47 p, 6 fig, 11 tab, 30 ref, 1 append.

Descriptors: *Hawaii, *Stream improvement, *Ecological effects, *Aquatic habitat, Streams, Channel improvement, Stream stabilization, Perennial streams, Fish, Water quality, Water temperature, Hydrogen ion concentration, Conductivity.

Three physiochemical features (water temperature, pH, conductivity) were measured to obtain a general idea of habitat factors in altered and unaltered streams. The aquatic community structure was evaluated for each stream and interstream comparisons were made. The altered streams were found to have higher mean physiochemical values coupled with wider ranges than unaltered streams. Channel sections with artificial (concrete) bottom exhibited higher values compared with natural bottom channels. Exotic fish species were predominant in altered streams while both exotic fish and native crustaceans were predominant in unaltered streams. Native fishes appeared to be especially reduced in heavily channelized streams. Altered channels with artificial bottoms appear to serve as nurseries for the exotic poeciliids, Poecillia mexicana and Poecilia reticulata. Species diversity was lower in these artificial bottom channels. (See also W80-00003) (Steiner-Mass)
W80-00004

RELATIONSHIPS BETWEEN RESPIRATORY CANCER AND WETLANDS RESIDENCY IN LOUISIANA,
Louisiana State Univ. Medical Center, New Orleans. Dept. of Preventive Medicine.
A. W. Voors, W. D. Johnson, S. H. Steel, and H. Rothschild.
Archives of Environmental Health, Vol. 33, No. 3, p 124-129, May-June, 1978. 5 fig, 2 tab, 31 ref.

Descriptors: *Wetlands, *Louisiana, *Public health, *Mortality, Diseases, Hazards, Land use.

Multiple regression analysis was applied to cancer mortalities in the State of Louisiana which were adjusted for age and urban residency, and specific for race, sex, amount of standing water in the parish of residency, and cancer site. The smoking related cancer mortality for men showed not only an association with residence in wetlands but also was higher in the Louisiana wetlands than in the remainder of the United States. (Howard-Mass)
W80-00015

THE FLUVIAL SYSTEM: SELECTED OBSERVATIONS,
California Univ., Santa Barbara. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2E.
W80-00019

DATA COMPILATION OF PERIPHYTON COLONIZED ON ARTIFICIAL SUBSTRATES PLACED IN THE SACRAMENTO AND FEATHER RIVERS, CALIFORNIA, 1975,
Geological Survey, Menlo Park, CA. Water Resources Div.
L. J. Britton, and R. F. Ferreira.
Available from Branch of Distribution, USGS Box 25425, Fed. Ctr. Denver, CO. 80225. Microfiche $3.50, Paper copy $4.50. Geological survey open-file report 79-696, May 1979. 33 p, 2 fig, 3 tab, 7 ref.

Descriptors: *Periphyton, *Growth stages, *Artificial substrates, *Water quality, *Environmental effects, Sediment transport, Suspension, Streams, Phytoplankton, Biomass, Data collections, California, *Sacramento River, *Feather River(CA).

Periphyton was collected from artificial substrates placed in the Sacramento and Feather rivers, California, and analyzed to determine the rate of colonization and succession of periphyton types with time. Samples for determination of water-quality characteristics, especially suspended-sediment concentrations, that might have a direct effect on the growth of periphyton were collected during each station visit. This paper describes the methods of data collection and presents qualitative and quantitative findings of periphyton collected during two colonization periods (August 5-September 5, 1975, and November 28-December 29, 1975) and associated water-quality data. (Woodard-USGS)
W80-00223

WEED CONTROL METHODS FOR RIVER BASIN MANAGEMENT,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 2I.
W80-00323

INTERNATIONAL ENVIRONMENTAL IMPLICATIONS OF SOVIET DEVELOPMENT OF THE VOLGA RIVER,
Western Michigan Univ., Kalamazoo.
For primary bibliographic entry see Field 6E.
W80-00368

7. RESOURCES DATA

7A. Network Design

PYRITE: ITS RAPID FORMATION IN A SALT MARSH AND ITS IMPORTANCE TO ECOSYSTEM METABOLISM,
Woods Hole Oceanographic Institution, MA. Joint Program in Biological Oceanography.
For primary bibliographic entry see Field 2K.
W80-00311

NITROGEN DYNAMICS AND MODELING IN A FRESHWATER WETLAND,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 2K.
W80-00327

7B. Data Acquisition

REMOTE SENSING AS A TOOL FOR STUDYING THE ECOLOGY OF HALOPHYTES,
Georgia Univ., Sapelo Island. Marine Inst.
J. L. Gallagher.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.). Academic Press, Inc., New York, p 511-523, 1974. 5 fig, 1 tab, 23 ref.

Descriptors: *Remote sensing, *Halophytes, *Ecology, Wetlands, Marshes, Mapping, Salt marshes, Photogrammetry, Marsh plants, Aerial photography, Distribution patterns.

The most widespread use of remote sensing techniques to date has been in mapping the distribution of various halophyte stands. Recently ecologists are beginning to seek answers to questions of production, the detection of nutrient changes and the sequence of inundation of the various stands of intertidal halophytes. Detection and analyzing techniques, as well as interest, are developing rapidly and new applications of remote sensing to answering questions of halophyte ecology will soon be realized. (Steiner-Mass)
W80-00037

GUIDELINES FOR THE USE OF STRUCTURAL VERSUS REGRESSION ANALYSIS IN GEOMORPHIC STUDIES,
Geological Survey, Lawrence, KS. Water Resources Div.
W. R. Osterkamp, J. M. McNellis, and P. R. Jordan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 360, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-135, November 1978. 22 p, 6 fig, 2 tab, 10 ref.

Descriptors: *Geomorphology, *Structural analysis, *Regression analysis, *Evaluation, Simulation analysis, Methodology, Equations, Alluvial channels, Streamflow, Gradation, Curve-fitting techniques.

Regression analysis is a useful curve-fitting technique, but it often is misapplied to geomorphic data sets. When error components can be identified for both variables, the statistical technique of structural analysis is preferred. If regression results are available, conversion to a structural analysis can be made either manually or by computer. Use of computer-generated data sets permits the construction of curves relating variation between regression and structural analyses to the range of data of the independent variable. The data have randomly imposed error components of specified standard deviation and a slope of the linear relation that simulates gradient-discharge relations of natural alluvial streams. The empirically developed curves can be used to determine the need for structural analysis of real geomorphic data sets. (Woodard-USGS)
W80-00224

AN INDUCTIVE-COUPLED PLASMA ATOMIC-EMISSION SPECTROMETRIC METHOD FOR ROUTINE WATER QUALITY TESTING,
Geological Survey, Denver, CO. Water Resources Div.
J. R. Garbarino, and H. E. Taylor.
Applied Spectroscopy, Vol. 33, No. 3, p 220-225, 1979. 11 fig, 7 tab, 28 ref.

Descriptors: *Water analysis, *Chemical analysis, *Analytical techniques, *Spectrometers, *Metals, Trace elements, Water quality, *Emission spectrometry, *Inductively coupled plasma.

Induction-coupled plasma atomic-emission spectrometry offers an ideal method for simultaneous multielement analysis of natural water samples. The Water Resources Division of the U.S. Geological Survey currently employs this technique for quantitative analysis of 17 major and trace constituents. These include analysis of Ba, Be, Cd, Co, Cu, Fe, Pb, Li, Mn, Sr, Mo, V, Zn, Ca, Mg, Na, and SiO2 in a routine production mode, in which an excess of 1,000 determinations can be made in a normal working day. Comparability studies with conventional single-element methods of analysis, such as atomic absorption spectrometry and colorimetric techniques, show essentially equivalent accuracy and precision, frequently at much higher sensitivity. (Woodard-USGS)
W80-00229

FORMULATION AND TESTING OF A NEW WATER QUALITY INDEX,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
B. Ibbotson, and B. J. Adams.
In: Water Pollution Research in Canada 1977. Proc. of Twelfth Canadian Sympo. on Water Poll. Research, Univ. Toronto, Feb. 1977, and Eastern Div. Symp., Concordia Univ. Montreal, Dec. 1976, p 101-119. 2 fig, 1 tab, 2 equ, 17 ref.

Descriptors: *Water quality, *Indices, *Methodology, *Environmental control, Evaluation, Water supply, Phosphorus, Recreation, Matrix approach, Parameters, Raw water, Equations, Measurement, Data collection, Information display.

The need to protect our environment has promoted the development of new ways to communicate environmental information to policy makers and the general public. Presented is a new formulation which translates water quality parameter values into simple numerical results which can then be summed to give water quality index scores. The mechanism uses the matrix format to organize the display results with water quality parameters on one axis and common water activities on the other. The mechanism's task is then to assess the suitability of each parameter to each activity, and subsequently to render the results into simple scores. The index can be applied to any situation in which water quality is a consideration. Its applicability lies in its offering to the perspective user the opportunity to calibrate the index to the needs of a specific situation. The procedure offers a systematic approach that is highly flexible and that generates results which are easily understood. The principal reasons for developing this index mechanism are to enable presentation of a simplified measure of water quality and to augment expert assessment of raw water quality data, not to supplant this important aspect of water quality management. (Bell-Graf--Cornell)
W80-00304

SAMPLING MACRO-ORGANIC MATTER PROFILES IN SALT MARSH PLANT ROOT ZONES,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2I.
W80-00309

RAINFALL MEASUREMENT BY RADAR,
British Meteorological Office, Bracknell (England).
C. G. Collier.
Paper 1, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 31 p, 12 fig, 4 tab, 13 ref, 1 append.

Descriptors: *Remote sensing, *Radar, *Rainfall, Precipitation(Atmospheric), Instrumentation, Equipment, Measurement, On-site investigations, Rain gages, Networks, Watersheds(Basins), Data processing, Analytical techniques, Meteorology, *England.

During the last three years a weather radar has been used to measure surface rainfall over hilly terrain in North Wales. Up to autumn 1973, the radar in use was a Plessey Type 43 S-band with a wavelength of 10 cm; thereafter the radar was converted to C-band by changing the wavelength to 5.6 cm. The change of wavelength was carried out because it was an economical means of reducing the beam width. This was required, to reduce the number of occasions when the melting layer is intersected by the radar, which decreases the measurement accuracy, to reduce the amount of permanent echo, and to reduce the effect of low level changes in rainfall on the accuracy of estimates of rainfall at the surface. A comparison between the accuracy of surface rainfall measurements over sub-catchments using the S- and C-band radars revealed no difference in the accuracies other than that directly attributable to different meteorological conditions during the two periods of operation. A comparison between a rain gage calibrated radar system and rain gage networks of various densities revealed that when the melting layer is above the top of the radar beam, the radar measurements for one-hour periods calibrated with the readings from two rain gages at two different sites within the area of 1,000 sq km, had a mean error over sub-catchments of 18%. This accuracy may be achieved with a rain gage network of 8 rain gages per 1,000 sq km in widespread rain, and about 50 rain gages per 1,000 sq km in showery weather. (Sims-ISWS)
W80-00329

A SYSTEM FOR REAL-TIME PROCESSING TRANSMISSION AND DISPLAY OF RADAR-DERIVED RAINFALL DATA,
Royal Radar Establishment, Malvern (England).
B. C. Taylor.
Paper 2, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 15 p, 8 fig, 5 ref.

Descriptors: *Radar, *Rainfall, *Remote sensing, Data processing, Communication, Computers, Equipment, Instrumentation, Precipitation(Atmospheric), Rainfall intensity, Analytical techniques, Meteorology, *England, Data display.

A computer-based system was described which at low cost can make available in real time and to a large number of users digitized data on precipitation intensity (mm/hr) or amount (mm) with a high resolution in space and time. The data can be presented to meteorological, hydrological, and other users as a color-coded image on a standalone television terminal, or on a conventional teletype, or it can be fed directly to a user computer for further manipulation. All communications between radar site and users are over standard telephone circuits. Systems have been installed at three research radar stations, and television terminals remotely displaying the radar-derived rainfall patterns have been operating in the Central Forecast Office, Bracknell, and the Welsh National Water Development Authority Office, Bala (North Wales), since February 1975. With the recent installation of a PDP11 computer at Bala, that location is now receiving sub-catchment rainfall totals in addition to the overview data for display. The new system, with the variety of outputs it makes available, should encourage a much wider adoption of weather radar for operational uses in meteorology, hydrology, and other fields (e.g., aviation, civil engineering) which can benefit from real-time (and eventually forecast) rainfall data. (Sims-ISWS)
W80-00330

DESIGN OF THE DEE TELEMETRY SYSTEM WITH COMPUTER ACQUISITION OF DATA,
Water Resources Board, Reading (England).
A. A. Rowse, and B. H. Roberts.
Paper 3, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 21 p, 5 fig, 3 ref, 1 append.

Descriptors: *Rain gages, *Radar, *Water levels, *Data collections, Telemetry, Data transmission, Runoff, Lakes, Streamflow, Equipment, Instrumentation, Design, Rainfall, Precipitation(Atmospheric), Weather data, Meteorology, *England, *River Dee, Data display.

The upstream portion of the River Dee catchment in North Wales contains a regulating reservoir, Llyn Celyn (storage capacity 80 million cu m) and a natural lake, Llyn Tegid at Bala, adapted for flood control purposes (storage capacity 18 million cu m). A second regulating reservoir, Brenig (initial storage capacity 60 million cu m) is under construction. In addition, there is the Alwen direct supply reservoir. The river basin covers some 1,800 sq km. Research on the Dee is being carried out to ascertain the possible benefits of using a real-time mathematical model for the control and operation of the multi-purpose reservoir system. The input data it requires are gathered by telemetry; this paper described the design philosophy adopted and the equipment maintenance and discussed the reliability achieved in this difficult terrain. The computer acquisition of data was also described. The computer system at the Control Centre comprises a PDP 11/40 processor with a 2.4 megabyte cartridge disc and 32K of core store. It is linked to a variety of peripherals such as the outstation control unit, the mimic panel, the color VDU TV monitor system, etc. The software has been designed to meet the specifications of the System in such a way that it can be understood and modified by personnel who are not primarily software specialists. (Sims-ISWS)
W80-00331

INSTALLATION AND OPERATION OF THE DEE TELEMETRY SYSTEM,
Welsh National Water Development Authority, Cardiff (Wales).
D. J. Roberts, and P. Mainwaring.
Paper 4, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 7 p.

Descriptors: *Telemetry, *Rainfall, *Water levels, *Instrumentation, Equipment, Radar, Rain gages, Streamflow, Lakes, Storage, Reservoirs, Reservoir operation, Precipitation(Atmospheric), Weather data, Meteorology, Hydrology, *England, *Wales, *River Dee.

The Dee telemetry system has been in operation for approximately four years, and it has been possi-

ble to assess its limitations and also to satisfy the requirements of the various other participants in the Dee Research Programme. The installation of the system was described, and the solutions of problems incurred were reported. Operational problems were also reported. (Sims-ISWS)
W80-00332

CAPITAL AND OPERATING COSTS OF THE EXISTING DEE RADAR, TELEMETRY AND FLOW FORECASTING PROJECT,
Water Resources Board, Reading (England).
R. B. Bussell.
Paper 5, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 7 p.

Descriptors: *Costs, *Radar, *Telemetry, *Rain gages, Rainfall, Precipitation(Atmospheric), Lakes, Reservoirs, Water levels, Flow, Rivers, Equipment, Instrumentation, Data collections, Remote sensing, Networks, Meteorological data, Meteorology, Hydrology, *England, *Wales, *River Dee.

In this paper were given the major costs of equipment and some services which have been used from time to time throughout the Dee Projects, together with an indication of the probable cost of setting up a new rainfall radar station. No costs were given in respect of the time of research staff engaged upon the project. It must be appreciated that due to the accounting methods used and the many authorities and bodies which have been involved and the consequences of reorganization and staff changes since the beginning of the Project, many of the figures are of a rounded budget nature. Appropriate brief descriptions of the chronological order of events were given as necessary. For this reason, the various component parts were first dealt with separately and then combined in the summary. All costs shown, unless otherwise stated, have been rounded up to July 1975 values. During the passage of the works, various small items of capital cost have been incurred, e.g., mobile radios for transport, cleaning equipment, photocopiers, supplies of magnetic tape, etc. No figures were given for such items. No attempt was made to allow for the recoverable current value of capital equipment held. (Sims-ISWS)
W80-00333

RAINFALL FORECASTS IN THE UNITED KINGDOM USING RADAR DATA,
British Meteorological Office, Bracknell (England).
For primary bibliographic entry see Field 2B.
W80-00336

OPERATIONAL USE OF DIGITAL RADAR IN RAINFALL MEASUREMENT AND PREDICTION,
National Weather Service, Silver Spring, MD. Office of Hydrology.
D. R. Greene.
Paper 9, Weather Radar and Water Management, Water Research Centre, Marlow (England), and Royal Radar Establishment, Malvern (England), 1976. 15 p, 7 fig, 7 ref.

Descriptors: *Radar, *Rainfall, *Data processing, Remote sensing, Analytical techniques, Equipment, Computers, Precipitation(Atmospheric), Flash floods, Measurement, Forecasting, Data transmission, Meteorology, Engineering, *D/RADEX.

This paper presented a preview and theoretical basis for the operational hydrologic program planned for the Pittsburgh D/RADEX site. Its primary aim was the measurement and prediction of rainfall for flash-flood monitoring. It should be noted that D/RADEX is in a transitional period from experimental to operational. Procurement and implementation of the operational system, RADAP (RAdar DAta Processor) for which the Pittsburgh D/RADEX is a prototype, will begin within the next 2 years. Current planning within the NWS calls for implementation of RADAP at 11 sites during the next 5 years. (Sims-ISWS)
W80-00337

A TELEMETRY SYSTEM WORKING THROUGH THE PUBLIC TELEPHONE NETWORK,
Louvain Univ. (Belgium).
For primary bibliographic entry see Field 2E.
W80-00339

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR NEBRASKA, WATER YEAR 1978.
Geological Survey, Lincoln, NE. Water Resources Div.
Geological Survey Water-Data Report NE-78-1, May 1979. 514 p, 5 fig, 3 tab.

Descriptors: *Nebraska, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Nebraska consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 155 gaging stations; stage and contents for 10 lakes and reservoirs; water quality for 55 gaging stations, 17 ungaged stations, 36 partial-record flow stations, and 241 wells; and water levels for 65 observation wells. Also included are 112 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Nebraska. (Woodard-USGS)
W80-00234

WATER RESOURCES DATA FOR ALABAMA, WATER YEAR 1978.
Geological Survey, University, AL. Water Resources Div.
Geological Survey Water-Data Report AL-78-1, March 1979. 568 p, 7 fig, append.

Descriptors: *Alabama, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Alabama consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 95 gaging stations, stage only for 16 gaging stations, stage and contents for 12 lakes and reservoirs, water quality for 64 gaging stations and water levels for 59 observation wells. Also included are 23 crest-stage partial-record stations, 11 flood hydrograph partial-record stations, and 24 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alabama. (Woodard-USGS)
W80-00235

UNITED STATES GEOLOGICAL SURVEY YEARBOOK, FISCAL YEAR 1978.
Geological Survey, Reston, VA. Water Resources Div.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $5.50. 1979. 208 p.

Descriptors: *Reviews, *Annual, *Projects, *Data collections, *Natural resources, Water resources, Water quality, Energy, Mapping, Geological surveys, Volcanoes, Landslides, Indian reservations, Mineralogy, Land management, Oil industry, Programs, Administration, Cost allocation, Budgeting, *US Geological Survey.

This Yearbook summarizes the progress made by the United States Geological Survey during fiscal year 1978 in its mandated role--to identify the Nation's land, water, energy, and mineral resources; to classify Federally owned mineral lands and waterpower sites; to regulate the exploration and development of energy and mineral resources on Federal and Indian lands; and to explore and appraise the petroleum potential of the National Petroleum Reserve in Alaska. As a report to Congress and the public, it falls logically into five parts: (1) The Year in Review; a look at the major issues and events which affected Survey programs, and some performance highlights; (2) Perspectives; a series of concise earth-science essays which address national issues; (3) Missions, Organization, and Budget; a description of the Geological Survey's major duties and assignments and of the organizational and fiscal structures that support its missions; (4) A description of the activities and accomplishments of each of the operating Divisions and Offices; and (5) Statistical Data; tabular summaries which document program trends, workloads, and significant 1978 accomplishments. (Woodard-USGS)
W80-00236

MAPS SHOWING GROUND-WATER CONDITIONS IN THE LOWER SANTA CRUZ AREA, PINAL, PIMA, AND MARICOPA COUNTIES, ARIZONA--1977,
Geological Survey, Tucson, AZ. Water Resources Div.
A. D. Konieczki, and C. S. English.
Geological Survey Water-Resources Investigations 79-56 (open-file report), March 1979. 4 sheets, 12 ref.

Descriptors: *Maps, *Groundwater, *Irrigation wells, *Water levels, *Water quality, Aquifer characteristics, Withdrawal, Water yield, Drawdown, Land use, Arizona, *Lower Santa Cruz area(AZ), Pinal County, Pima County, Maricopa County.

The lower Santa Cruz area includes about 5,400 square miles in south-central Arizona and is the second largest agricultural area in the State. The area depends mainly on ground water for irrigation, and in 1976 about 966,000 acre-feet of ground water was pumped from the area. As a result of the large-scale long-term withdrawal of ground water, water levels have declined, and the direction of ground-water flow has changed. Since 1923, declines of nearly 500 feet have occurred near Stanfield. Information shown on the maps (scale 1:125,000) includes depth to water, altitude of the water level, specific conductance, fluoride concentration, change in water level (1923-77), and land use. Hydrographs of the water level in selected wells and a table of historical pumpage also are included. (Woodard-USGS)
W80-00239

WATER RESOURCES OF THE ZUMBRO RIVER WATERSHED, SOUTHEASTERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
H. W. Anderson, Jr., D. F. Farrell, W. L. Broussard, and M. F. Hult.
Available from Branch of Distribution, USGS Box 25286, Fed. Ctr. Denver, CO 80225 price $4.25.
Geological Survey Hydrologic Investigations Atlas HA-543, 1975. 3 sheets, 8 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Water quality, *Hydrologic budget, Water availability, River basins, Water utilization, Domestic water, Municipal water, Irrigation, Livestock, Industrial water, Streamflow, Flow rates, Aquifer characteristics, Water yield, Maps, Hydrographs, Curves, Hydrologic data, Water types, Water analysis, *Zumbro River basin(MN), Southeastern Minnesota.

The Zumbro River drains 1,428 square miles and falls from about 1,300 feet altitude in its headwaters to 665 feet at its mouth. The remaining 248 square miles included in the watershed is drained by small creeks flowing directly into the Mississippi River. Distribution of water use is about as follows: domestic, 50 percent; farm (for irrigation and livestock), 18 percent; and industrial, 32 percent. Total usage, in water-budget terms, is 0.24 inch over the entire watershed, or less than 1 percent of inflow (average annual precipitation). Total quantity of water, thus, is of lesser concern than local availability and quality of water. The dominant ions (calcium, magnesium, and bicarbonate) and dissolved solids are reduced by dilution during periods of high water discharge in the Zumbro River at Zumbro Falls. Similarly, in the South Fork Zumbro River near Rochester, dominant ions, dissolved solids, and those ions that are increased by waste disposal (sodium, chloride, and nitrates) are all reduced by dilution at high water discharge. For the Zumbro River the smallest monthly range and the most uniform daily mean discharge usually occurs in January, whereas the greatest range usually occurs in March. The lowest flows usually occur in the winter and the highest during the spring ice breakup. The lowest observed flow, 47 cfs, occurred on February 18, 1961 and the highest, 23,600 cfs, occurred on March 29, 1962. Seventeen of 22 municipalities obtain at least part of their water supply from the Prairie du Chien-Jordan aquifer. Although only one town uses the Galena aquifer, a large number of private domestic wells are completed in it in the western part of the watershed. (Woodard-USGS)
W80-00240

8. ENGINEERING WORKS

8A. Structures

SOIL INVESTIGATIONS: RICHELIEU DAM PROJECT, ST. JOHN'S SHOAL, ST. JOHN, ST. JOHN'S COUNTY, QUEBEC.
Mon-Ter-Val, Inc., Montreal (Quebec).
For primary bibliographic entry see Field 8D.
W80-00042

THE COMPARTMENTED RESERVOIR: EFFICIENT WATER STORAGE IN FLAT TERRAIN AREAS OF ARIZONA,
Arizona Water Resources Research Center, Tucson.
C. B. Cluff.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1978 Meetings of the Arizona Section-American Water Resources Assn. and the Hydrology Section-Arizona Academy of Science, Vol. 8, April 14-15, 1978, Flagstaff, Arizona, p 65-72, 5 fig, 5 ref.

Descriptors: *Reservoir storage, *Reservoir operation, *Reservoir design, *Model studies, *Water storage, Water management(Applied), Water yield improvement, Computer models, Hydrologic data, Design criteria, Hydrologic budget, Evaporation control, Depth-area curves, Pumped storage, Arizona.

A compartmented reservoir system to increase the efficiency of water storage in flat terrain, high evaporation areas in Arizona and other arid regions is described. Based upon the principle that evaporation loss can be controlled by a reduction in the surface area to depth ratio, the system attempts to concentrate water by pumping it from one compartment to another. A computer model has been developed to study the parameters involved in the system including the volume, area, depth, slope of the embankment around each compartment and their relationship to each other; and to facilitate the selection of optimal design configuration. These parameters interface with the parameters describing the rainfall and hydrologic characteristics of the watershed. A selected number of existing and new reservoir sites in Arizona are presently being studied to provide additional examples of the improvement in efficiency available through use of compartmented reservoir. (Tickes-Arizona)
W80-00277

8B. Hydraulics

VELOCITY PROFILES AND MINIMUM STREAM POWER,
Minnesota Univ., Minneapolis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-00077

BOUNDARY ELEMENT METHOD FOR FLUID FLOW,
Southampton Univ. (England). Dept. of Civil Engineering.
C. A. Brebbia, and L. C. Wrobel.
Advances in Water Resources, Vol. 2, No. 2, p 83-89, June 1979. 10 fig, 1 tab, 8 ref.

Descriptors: *Boundary processes, *Fluid mechanics, *Analytical techniques, Methodology, Mathematical models, Heat flow, Seepage, Dams, Circulation, Water circulation, Winds, Groundwater, Groundwater movement, Theoretical analysis, *Boundary element method.

The boundary element method was applied to some fluid flow problems. The methodology was presented in matrix form, starting with a simple time independent potential problem with steady state boundary conditions including free surface. A formulation of time dependent problems, which implies a fundamental solution depending on time as well as the spatial coordinates, was presented. (Sims-ISWS)
W80-00083

INTERFACIAL STABILITY IN CHANNEL FLOW,
Vanderbilt Univ., Nashville, TN. Dept. of Environmental and Water Resources.
For primary bibliographic entry see Field 2E.
W80-00297

8D. Soil Mechanics

SOIL INVESTIGATIONS: RICHELIEU DAM PROJECT, ST. JOHN'S SHOAL, ST. JOHN, ST. JOHN'S COUNTY, QUEBEC.
Mon-Ter-Val, Inc., Montreal (Quebec).
December, 1973. 29 p, 5 append.

Descriptors: *Dams, *Soils, *Physical properties, *Hydraulic structures, Bearing strength, Excavation, Sheet piling, Cofferdams, Caissons, Structures.

Methods used in the investigation are discussed. Bored materials indicated that the overburden consists of till with a small percentage or fraction of residual soils in contact with the parent rock; bored bedrock was entirely Utica shale. Comments and recommendations are made concerning the bearing capacity of till and bedrock excavation procedures. (Stihler-Mass)
W80-00042

8E. Rock Mechanics and Geology

SOIL INVESTIGATIONS: RICHELIEU DAM PROJECT, ST. JOHN'S SHOAL, ST. JOHN, ST. JOHN'S COUNTY, QUEBEC.
Mon-Ter-Val, Inc., Montreal (Quebec).
For primary bibliographic entry see Field 8D.
W80-00042

8G. Materials

PHYSICAL AND ENGINEERING PROPERTIES OF HAZARDOUS INDUSTRIAL WASTES AND SLUDGES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
M. J. Bartos, and M. R. Palermo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 266, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-139, 1977. 88 p, 37 fig, 15 tab, 9 ref.

Descriptors: *Sludge treatment, *Industrial wastes, *Electric power industry, *Coals, *Physical properties, Chemical reactions, Durability, Compaction, Compressive strength, Strength of materials, Landfills, Embankments, Engineering structures, Ultimate disposal, Sludge disposal.

The characteristics of raw and mechanically fixed hazardous industrial wastes and flue gas desulfurization sludges were studied in a laboratory testing program. Raw and fixed sludges were examined for grain size distributions, Atterberg limits, specific gravities, relationships between volume, weight and moisture, and permeabilities. Compaction and unconfined compression tests and wet-dry and freeze-thaw tests for durability were performed on selected fixed sludge. Chemical fixing of the sludges resulted in significant changes in the sludge properties which were similar to soil, soil-cement, or low-strength concrete; the characteristics were dependent upon the fixing process. Fixed sludge demonstrated substantial engineering strength and were considered suitable for landfill and embankment construction. Weathering of fixed sludge may be a problem unless the sludges are covered with earth. Leaching data is contained in an interim report. (Lisk-FRC)
W80-00243

8I. Fisheries Engineering

EMERGENCY AERATION OF FISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd, and C. S. Tucker.
Transactions of the American Fisheries Society, Vol. 108, No. 3, p 299-306, May 1979. 2 fig, 7 tab, 17 ref. OWRT B-076-ALA.

Descriptors: *Ponds, *Fish, *Aeration, Dissolved oxygen, Pumping, Mixing, Circulation, Water circulation, Farm ponds, Phytoplankton, Oxygen, Equipment, On-site investigations, Evaluation, Measurement, Agriculture, *Fish farming.

Dissolved oxygen (DO) concentrations were depressed in 0.57-hectare fish ponds through algicide treatment, and the effectiveness of different techniques of emergency aeration was compared. The most effective device for emergency aeration was a paddle-wheel aerator powered by a tractor. A tractor-powered Crisafulli pump with a discharge capacity of 18.9 cu m/minute was also a relatively effective aeration device when used either to spray DO-deficient water into the air and back into the pond or to pump fresh, oxygenated water from another pond into the one with low DO concentration. A lower capacity Rainmaster pump (3.8 cu m/minute) was much less effective than the Crisafulli pump when used to discharge oxygenated water into a DO-depleted pond. Neither of the pumps raised DO concentrations appreciably when used to circulate DO-deficient water in ponds. Three sizes (0.25, 2.2, and 3.7 kilowatts) of spray-type surface aerators failed to appreciably increase DO concentrations. (Sims-ISWS)
W80-00192

FLOOD ELEVATIONS FOR THE SOOES RIVER AT PROPOSED FISH HATCHERY, CLALLAM COUNTY, WASHINGTON - A SURFACE-WATER SITE STUDY,
Geological Survey, Tacoma, WA. Water Resources Div.
J. H. Bartells.
Geological Survey Water-Resources Investigations 78-130 (open-file report), 1979. 28 p, 4 fig, 6 ref.

Descriptors: *Flood frequency, *Forecasting, *Baseline studies, *Analytical techniques, *Elevation, Tides, Water levels, Streamflow, Discharge(Water), Construction, Sites, Fish hatch-

eries, *Clallam County(WA), *Sooes River(WA), *Neah Bay(WA).

Water-surface elevations were derived for various combinations of selected river discharges and tide elevations along a reach of the Sooes River 3 miles upstream from the mouth at the site of a proposed fish hatchery in Clallam County, Washington. Flood-frequency analyses determined river discharges having exceedence probabilities of 1, 2, 4, 10 and 20 percent (100-, 50-, 25-, 10-, and 5-year recurrence intervals) and tide elevations having exceedence probabilities of 1 and 50 percent (100- and 2-year recurrence intervals). A relationship was developed for determining river water-surface elevation for different combinations of river discharge and tide elevations. Seven different combinations of river flood-plain conditions that may be expected to occur during and after construction were simulated and water-surface elevations determined by use of the step-backwater computer program.
W80-00231

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 2
JANUARY 15, 1980

W80-00401 – W80-00800
CODEN: SWRABW

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 2
JANUARY 15, 1980

W80-00401 -- W80-00800

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SUBJECT FIELDS AND GROUPS

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01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

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08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

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SUBJECT INDEX

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

TILLAMOOK BAY ENTRANCE REFRACTION STUDY, TILLAMOOK, OREGON,
Army Engineer Waterway Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W80-00501

1B. Aqueous Solutions and Suspensions

BEST WAYS TO DEWATER DREDGED MATERIAL,
Oklahoma State Univ., Stillwater. Dept. of Geotechnical Engineering.
For primary bibliographic entry see Field 2G.
W80-00733

2. WATER CYCLE

2A. General

NOTE TO THE UNITED NATIONS WATER CONFERENCE ON PREPARATIONS FOR THE UNITED NATIONS CONFERENCE ON DESERTIFICATION.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 2, p 865-870.

Descriptors: *Arid lands, *Desertification, *Deserts, *International cooperation, *United Nations, Arid climates, Ecology, Ecosystems, Technology, Environmental effects, Climate, Reviews, Maps, Planning, Regional planning, Water management(Applied), Tunisia, Chile, Niger, India, Iraq, Pakistan, Australia, Iran, Israel, Oregon, Soviet Union, China.

The United Nations Conference on Desertification will deal with ecological situations in which: (1) water is scarce due to climate, and (2) the ecosystem is degraded because of human interference. Maps were produced of world deserts and desertification (1:25 million), and of aridity showing ratios between rainfall and potential evapotranspiration, as well as topography, soils, and vegetation. Other maps will show desertification in Africa north of the equator (1:5 million), possibly a similar one on South America, a climate aridity map of the world based on Budyko's radiational index of dryness, and maps of case study areas. Four global component reviews were prepared to assess present knowledge of desertification in relation to: (1) climate, (2) ecological change, (3) technology, and (4) population and society. An overview of the reviews will also be presented, which will provide scientific guidelines and justification for the Plan of Action to Combat Desertification. Case studies will be in two series: (1) six UNESCO studies of portions of Tunisia, Chile, India, Niger, Iraq, and Pakistan; and (2) nine studies prepared by the governments of Australia, China, Iran, Israel, United States, and Soviet Union. A Synthesis of the Case Studies will summarize conclusions. Feasibility studies for transnational projects will be conducted. The Plan of Action will provide guidelines and recommendations for measures at the national, regional, and international levels, addressing problems of both land and people. Water management will be a central issue. (Lynch-Wisconsin)
W80-00422

ENVIRONMENTAL ISSUES IN RIVER BASIN DEVELOPMENT,
United Nations Environment Program, Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, Part 3, p 1163-1172.

Descriptors: *Dams, *Environmental effects, *Ecosystems, *Water supply development, *River basin development, Aquatic weeds, Social impact, Public health, Human diseases, Schistosomiasis, Malaria, Trypanosomiasis, Onchocerciasis, Ecology, Wetlands, Eichhornia crassipes, Pistia stratiotes, Habitats.

Environmental effects of dam construction in river basins and methods of minimizing such effects are described. Large dams tend to have particularly significant and complex effects on aquatic ecosystem which must be carefully evaluated prior to construction. Rational development involves: (1) a comprehensive basinwide assesment of social, economic, and ecological characteristics and of the effects of development; (2) evaluation of development alternatives reflecting social, economic, and environmental factors to provide the basis for environmental management. Dam construction can provide the water supply, hydroelectric power, and flood control, and can greatly improve agriculture, forestry, and livestock management. Excessive use of water and agricultural chemicals can however, cause waterlogging and salinization, and can affect water quality and quantity. Dams produce a permanent physical transformation, inundating settled areas and destroying habitats, affecting the groundwater regime and water table, possibly increasing seismic tendencies, and often leading to explosive aquatic weed growth and the spread of schistosomiasis and other communicable diseases. Dams in tropical areas tend to favor weed propagation and vectors of parasitic diseases, while temperate-zone dams often interfere with fish migration. Resettlement of population displaced by dams often leads to housing, disease, and social problems. Loss of wetlands endangers many plant and animal species. (Lynch-Wisconsin)
W80-00433

WORLD WATER BALANCE AND WATER RESOURCES OF THE EARTH,
National Committee for the International Hydrological Programme (USSR).
V.I.I. Korzoun, and A. A. Sokolov.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2199-2215.

Descriptors: *World, *Water resources, *Water balance, *Oceans, *Precipitation(Atmospheric), *Hydrologic cycle, Freshwater, Rivers, River basins, Runoff, Evaporation, Glaciers, Water storage, Forecasting, Estimating, Discharge(Water), Reservoirs, Water utilization, Consumptive use, Lakes, Distribution.

An inventory of world water resources and a global water balance are extracted from a monograph of the same title published in 1974. Sections include: (1) world water storage, (2) the water cycle and the world water balance, (3) dynamic (resumed) fresh-water resources and their world distribution, and (4) use of natural water. Static water storage is 1386 million cu km, 96.5% (1338 million cu km) in the world ocean. The major portion of water on the continents is in the solid phase, accumulated in glaciers and snow cover of the Antarctic, the Arctic, and Greenland. The major link in the water cycle is water exchange between ocean and land; 505,000 cu km annually evaporates from the ocean surface with 458,000 cu km (90%) returning to the ocean as precipitation and 47,000 (10%) as land discharge. Of total precipitation onto the land, 61% is lost to evaporation and 39% is discharged into the world ocean or large endorheic lakes. Total water resources of the earth amount to 577,000 cu km. Mean annual basin runoff is usually used to evaluate freshwater resources. At present, to supply a city of one million people, at least 0.5 million cu m of water/day are needed, to rise to 1.0 million in the future. Total water consumption has increased from 400 cu km/yr (270 cu km lost) in 1900 to 2600 cu km (1600 lost)in 1970. Consumption is expected to increase to 6000 cu km by the year 2000, with 3000 cu km lost. (Lynch-Wisconsin)
W80-00466

THE MAIN DIRECTIONS OF HYDROGEOLOGICAL INVESTIGATIONS FOR THE SUBSTANTIATION OF ARTIFICIAL RECHARGE,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology.
K. I. Sychev, M. A. Khordikainen, and V. S. Usenko.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2231-2248.

Descriptors: *Soviet Union, *Artificial recharge, *Groundwater recharge, *Water supply development, *Methodology, Groundwater, Hydrogeology, Aquifers, Water storage, Heated water, Water pollution control, Salinity, Water purification, Mapping, Research priorities.

Artificial recharge of groundwater and storage of surface runoff in natural subsurface reservoirs are the most effective methods of preventing groundwater depletion and of insuring their availability to the water supply. Such measures are used in the Soviet Union for: (1) increasing operating water intake yields, (2) regulating water resources, (3) improving water quality, (4) cooling water heated in air-conditioning systems, (5) forming freshwater lenses among saline ones, and (6) protecting aquifers from saline water intrusions and effluent contamination. Increasing groundwater quantity has helped purify polluted surface water. Artificial recharge is usually more economical than other water supply methods, and is 20-30% cheaper than surface water purification. The Soviet Union emphasizes: bed regulation of surface runoff; improving permeability of bottom deposits; induced seepage; and to a limited extent construction of special systems such as recharge basins, canals, infiltration galleries, ponds, temporary basins, and clearing of river bottom deposits. A program of research and development was carried out in 1971-75. Regional investigations, including mapping, identified the most suitable areas for recharge projects, and a substantiating methodology was devised which assesses: (1) water quantity and quality; (2) hydrogeological, sanitary, and technological conditions; (3) method selection; (4) recharge structure operation; (5) effects of recharge on groundwater quality; (6) water intake efficiency; and (7) economic effectiveness. (Lynch-Wisconsin)
W80-00468

ISRAEL- A MODEL OF EFFICIENT UTILIZATION OF A COUNTRY'S WATER RESOURCES,
Ministry of Agriculture, Tel-Aviv (Israel).
For primary bibliographic entry see Field 6E.
W80-00471

SIMULATION ANALYSES: THE DETAILED MODEL,
Simon Bolivar Univ., Caracas (Venezuela).
J. Valdes, B. Harley, and J. C. Schaake Jr.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 95-107, 1979. 4 fig, 19 ref.

Descriptors: *Simulation analysis, *Model studies, *Parametric hydrology, *Streamflow, *Water resources development, *Projects, *Hydrologic cycle, *Rio Colorado(Argentina), Snowmelt, Channel routing, Overland flow, Infiltration, Evapotranspiration, Salt balance, Groundwater, Reservoirs, Irrigation areas, Screening model, Hydrologic data, Diversion, Equations, Systems analysis.

The Rio Colorado study has utilized a basic simulation model for evaluating the overall performance of alternative development configurations. This chapter describes the nature and use of the detailed simulation model, used for the important supporting tasks of parameter estimation, streamflow generation, and verification, and contrasts it with the basic simulation model. The basic model uses a nodal structure, incorporating a set of projects and running a time series of streamflow through the system year by year; this unified model with simple physical representations analyzes complete river basin alternatives in terms of benefits and costs (see Chapter Six of the Major

and Lenton book). The detailed simulation model, however, has three types of components or modules: (1) those representing the hydrologic cycle as it characterizes the Rio Colorado, including snowmelt runoff, channel routing, overland flow, infiltration and evapotranspiration, groundwater flow, and salt balance; (2) those representing the types of development projects in the Rio Colorado, such as dams, irrigation areas, hydroelectric plants, and diversions, imports, and exports; and (3) that for generating synthetic streamflow series. The detailed simulation model includes explicit representations of hydrologic processes. The entire set of streamflows is run through the module found furthest upstream, and this process is repeated progressively down to the downstream end. The analysis in each module can be performed in terms of very small time steps, the length of which can be varied according to the degree of detail required. (Bell-Graf--Cornell)
W80-00561

LANDSAT-DERIVED SNOW COVER AS A FORECAST TOOL IN THE RIO GRANDE BASIN IN COLORADO,
Soil Conservation Service, Denver, CO.
For primary bibliographic entry see Field 2C.
W80-00573

A STORAGE ROUTING MODEL BASED ON CATCHMENT GEOMORPHOLOGY,
Wollongong Univ. (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-00590

FOUNDATION THEORIES OF SOLUTE TRANSPORT IN POROUS MEDIA: A CRITICAL REVIEW,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
G. Sposito, V. K. Gupta, and R. N. Bhattacharya.
Advances in Water Resources, Vol. 2, No. 2, p 59-68, June 1979. 1 tab, 39 ref. NSF ENG 76-09210, ENG 76-09081.

Descriptors: *Reviews, *Mathematical models, *Dispersion, *Porous media, *Solutes, *Theoretical analysis, Equations, Markov processes, Stochastic processes, Fluid mechanics, Hydrodynamics, Thermodynamics, Statistics, Velocity, Diffusivity, *Transport equations.

The theories that have been employed to derive the macroscopic differential equations that describe solute transport through porous media were reviewed critically. Theories of class 1 (those based in fluid mechanics) have had to employ highly artificial models of a porous medium or to assume that well-defined solutions of the equations of fluid mechanics exist in the porous medium. Theories of class 2 (those based in kinematic approaches) suffer from the absence of a firm dynamical basis for the stochastic properties they attribute to the velocity of a solute molecule. Theories of class 3 (those based on a formal analogy between statistical thermodynamics and hydrodynamic dispersion) have had an unclear physical content. None of the existing foundational theories has yet achieved the objectives of: (1) deriving, in a physically meaningful and mathematically rigorous fashion, the macroscopic differential equations of solute transport theory, and (2) elucidating the structure of the empirical coefficients appearing in these equations. (Visocky-ISWS)
W80-00606

NOTE ON THE DISTRIBUTION OF FLOOD MAXIMA FOR RANDOM SAMPLE SIZE,
Otago Univ., Dunedin (new Zealand). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W80-00611

ON THE THEORETICAL BASIS OF MODELLING THE QUALITY OF SURFACE AND SUBSURFACE WATERS,
Deutsche Akademie der Wissenschaften zu Berlin (German D.R.). Inst. fuer Geographie and Geookologie.
For primary bibliographic entry see Field 5B.
W80-00700

A DYNAMIC MODEL OF THE CHEMICAL NUTRIENT SYSTEM FOR RESEARCH OF THE ECOLOGICAL CONSEQUENCES IN NATURAL WATER,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5B.
W80-00701

AN EFFORT FOR MODELLING THE TRANSPORT OF MICROPOLLUTANTS IN RIVERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 5B.
W80-00702

HYDROLOGICAL AND GEOCHEMICAL MASS BALANCE IN SMALL FORESTED AND AGRICULTURAL BASINS,
Corporation for Engineering, Geological and Hydrological Investigation, Prague (Czechoslovakia). Stavebni Geologie.
J. Balek, B. Moldən, T. Paces, and J. Skorepa.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 50-58, 1978. 6 fig, 2 tab, 3 ref.

Descriptors: *Watersheds(Basins), *Runoff, *Water quality, *Hydrology, Mathematical models, Water balance, On-site investigations, Seasonal, Discharge(Water), Hydrographs, Demonstration watersheds, Forest watersheds, Agricultural watersheds, Foreign research, Water properties, Sodium, Calcium, Aluminum, Suspended load, Silica, Sulfur, Nitrogen, Phosphorous, Conductivity, *Czechoslovakia, Mass balance.

The mass balance of Na, Ca, Al, Si, Cl, S, N, and P in two drainage basins (0.984 and 0.586 sq km) indicates profound differences in the fluxes of the elements into and out of agricultural and forested areas. The seasonal variations in dissolved sodium and electrical conductivity correlate positively with the discharge when the surface runoff is negligible. The correlation is negative when the surface runoff is an important part of the total runoff. The concentration of sodium is in a steady state in spite of the fact that the flux of sodium from the basins exhibits seasonal variations. The surfaces of feldspars exposed to solution by interflow and groundwater flow may be the cause of this phenomenon. A simple model was presented for the three-part separation of the hydrograph using the measurements of electrical conductivity during a rapid rainfall. (See also W79-00379) (Humphreys-ISWS)
W80-00703

EFFECTS OF THE CONSTRUCTION OF A BROAD WATERWAY ON THE WATER QUALITY OF THE DOUBS (EFFETS DE LA CANALISATION A GRAND GABARIT SUR LA QUALITE DES EAUX DU DOUBS),
Electricite de France, Chatou. Direction des Etudes et Recherches.
For primary bibliographic entry see Field 5B.
W80-00704

MASS TRANSFER MODELS OF SORPTION AND DESORPTION OF RADIONUCLIDES BY AQUATIC PLANTS,
Institute of Meteorology and Water Management, Warsaw (Poland).
M. J. Gromiec, and S. Matsui.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 68-76, 1978. 1 fig, 1 tab, 7 ref.

Descriptors: *Mass transfer, *Model studies, *Aquatic environment, *Water quality, Sorption, Radioisotopes, Aquatic plants, Mathematical models, Algae, Chlorella, Mercury, Chlorides, Kinetics, Equations, Aquatic production, Radionuclide transport, Desorption.

The basic mathematical models describing the transport of radionuclides in an aquatic environment and containing the uptake and release terms were presented. The development of three mass transfer models employing a uniform function, an exponential function, and a power function to describe the kinetics of sorption and desorption was given. The application of the mass transfer models to the sorption and desorption kinetics of mercurials by the algal biomass was presented as an example. The sorption and desorption of mercuric chloride and methylmercuric chloride by Chlorella pyrenoidosa were described respectively by the uniform function model and the exponential function model. The influence of environmental factors on the biological accumulation of mercurials in algae was also discussed. The application of these transfer models indicates the possible involvement of two distinct mechanisms. These models of the sorption and desorption may be applied to forecast levels of concentration and the extent of desorption from algae, as well as determining the rate of these processes in relation to specific ecological conditions. (See also W79-00379) (Humphreys-ISWS)
W80-00705

USE OF WATER QUALITY VARIABLES FOR ESTIMATION OF WATER QUANTITY CHARACTERISTICS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. Yevjevich, and T. G. Sanders.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 106-112, 1978. 3 fig, 12 ref.

Descriptors: *Water quality, *Hydrograph analysis, *Model studies, *Runoff forecasting, Demonstration watersheds, Rainfall-runoff relationships, Water properties, Tracers, Analytical techniques, Mathematical models, On-site tests, Flow, Discharge(Water), Runoff, Overland flow, Travel time, Water pollution, Herbicides, Volume.

This paper treated the two basic problems in which water quality properties are used for estimating the basic characteristics of water quantity hydrographs, namely: (1) the estimation of parameters for a kinematic wave model of overland flow by measuring the transport characteristics of chemical water quality variables; and (2) the estimation of the origin of water in a hydrograph resulting from partial rainfall coverage over a river basin by using various chemical tracers. These studies then indirectly represent the response of water quality variables in the form of responses of selected chemicals over the river basin to rainfall input. The results of studies presented may be considered as paralleling the study of migration of non-point sources of chemical, biological, or physical (debris) pollutants in river basin runoff hydrographs. Preliminary research on an impervious basin, the 24,000 sq ft rainfall-runoff facility at Colorado State University, has given indications that the peak concentration as well as the water quality hydrograph may also be estimated given the discharge hydrograph ofa small basin, and the areal distribution of the known amount of the tracer applied to the basin. (See also W79-00379) (Humphreys-ISWS)
W80-00709

STREAMFLOW GENERATION IN A FORESTED WATERSHED, NEW ZEALAND,
Forest Research Inst. Christchurch (New Zealand).
For primary bibliographic entry see Field 2E
W80-00724

A STATISTICAL METHOD FOR MODELLING THE FATE OF RAINFALL IN A TROPICAL RAINFOREST CATCHMENT,

James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W80-00748

GROUND-WATER APPRAISAL FOR THE COMMUNITY OF KIRYAS JOEL, ORANGE COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. M. Waller.
Geological Survey open-file report 79-401, 1979. 23 p, 9 fig, 3 tab, 7 ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Water quality, *Aquifer testing, *Groundwater potential, Water supply, Test wells, Pumping, Water yield, Aquifer characteristics, Fracture permeability, Surface-groundwater relationships, Evaluation, New York, *Orange County(NY), *Kiryas Joel(NY).

A major fracture system in indurated sedimentary rocks forms a moderately extensive aquifer yielding 100-300 gallons per minute to wells 160 to 420 feet deep. Pumping-test data show that the fracture system is interconnected to distances more than 1,000 feet from the wells. Recharge occurs through overlying clayey till, and continuous pumping may induce recharge from surface-water sources. Chemical analyses indicate no water-quality problems. Systematic collection of data on pumpage, water level, and chemical quality could help to determine the long-term adequacy of the aquifer system. (Woodard-USGS)
W80-00759

2B. Precipitation

INCREASING AVAILABLE WATER SUPPLIES THROUGH WEATHER MODIFICATION AND DESALINATION,
Bureau of Reclamation, Washington, DC.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2489-2501.

Descriptors: *Weather modification, *Desalination, *Water supply development, *Arid lands, *Pacific Coast Region, *Rocky Mountain Region, California, Colorado River Basin, Rio Grande Basin, Water sources, Water resources development, Water management(Applied), Cloud seeding, Cloud physics, Bureau of Reclamation, Geothermal studies, Project Skywater, Distillation, Reverse osmosis, Electrodialysis, Ion exchange, Membrane processes.

The current phase of the Federal Reclamation Act of 1902 and amendments mandates weather modification and desalination projects in the western U.S. Preliminary results of Project Skywater, the multiphase research program in cloud seeding (weather modification) indicates that seeding specific types of clouds either increases or decreases precipitation. Increases now generally range 8-15%, but may approach 30% with refined technology. Current research projects: (1) a cumulus cloud experiment at three sites on the western Great Plains, concerned with seeding summer convective clouds; and (2) winter cloud seeding technology in maritime air masses for enhanced snowfall (Sierra Nevada, California). Seeding with silver iodide is accomplished either from aircraft or from the ground using pyrotechnics. Four desalination processes are comercially available: (1) distillation, (2) reverse osmosis, (3) electrodialysis, and (4) ion exchange. Freezing processes are under development. Distillation is generally used for seawater, electrodialysis and reverse osmosis (membrane processes) for brackish water, and ion exchange as pretreatment for softening water or post-treatment for improving other desalting procedures. Bureau of Reclamation projects: (1) salinity control on the Colorado River, (2) desalting hot geothermal brines in southeast California, and (3) seawater desalting in California's Santa Barbara Channel. (Lynch-Wisconsin)
W80-00479

A WIND TUNNEL INVESTIGATION OF THE RATE OF EVAPORATION OF LARGE WATER DROPS FALLING AT TERMINAL VELOCITY IN AIR,
California Univ., Los Angeles. Dept. of Atmospheric Sciences.
H. R. Pruppacher, and R. Rasmussen.
Journal of the Atmospheric Sciences, Vol. 36, No. 7, p 1255-1260, July 1979. 2 fig, 21 ref. NSF ATM78-10817.

Descriptors: *Raindrops, *Evaporation, *Ventilation, *Laboratory tests, Precipitation(Atmospheric), Rainfall, Drops(Fluids), Particle size, Reynolds number, Cloud physics, Laboratory equipment, Instrumentation, Meteorology, Wind tunnels

An experimental study of the effect of ventilation on the rate of evaporation of millimeter sized water drops falling at terminal velocity in air has been carried out in a wind tunnel where drops were suspended freely in the tunnel air stream. It was found that for drops in the size range 1.15 and 2.50 mm in radius, the mean ventilation coefficient could be expressed as f = (0.78 + or - 0.02) + (0.308 + or - 0.010)X, where X = N sub Sc,v to the 1/3 power times N sub Re to the 1/2 power. Previously, it was shown that this relation holds for drops in the size range between 0.06 and 0.40 mm in radius. Taken together, present and previous data suggest that with reasonable accuracy f = 0.78 + 0.308 X, for X between 1.4 and 51.4 (between 0.06 and 2.50 mm in radius). For X between 0 and 1.4 (radius between 0 and 0.06 mm), one may use the previous result f = 1.00 + 0.108 X sq. To illustrate how the present data may be applied, the distance which is required for a water drop to travel from cloud base through a NACA Standard Atmosphere of various relative humidities in order to reach the earth's surface with a given size was computed. (Sims-ISWS)
W80-00602

DETAILED STRUCTURE OF PH IN HYDROMETEORS,
Maryland Univ., College Park.
For primary bibliographic entry see Field 2K.
W80-00616

WEAK AND STRONG ACIDS IN THE SURFACE WATERS OF THE TOVDAL REGION IN S. NORWAY,
Central Electricity Generating Board, Leatherhead (England). Research Lab.
For primary bibliographic entry see Field 2K.
W80-00624

PRECIPITABLE WATER OVER THE UNITED STATES. VOLUME II: SEMIMONTHLY MAXIMA,
National Weather Service, Silver Spring, MD. Office of Hydrology.
F. P. Ho, and J. T. Riedel.
NOAA Technical Report NWS 20, July 1979. 363 p, 22 fig, 3 tab, 15 ref.

Descriptors: *Precipitable water, *Water vapor, Moisture content, United States, Alaska, Semimonthly maxima.

Observed semimonthly maxima and means of the series of semimonthly maxima precipitable water are presented in tabular, graphical, and map form for all radiosonde stations in the contiguous United States for the period 1946-72 and for Alaska for the period 1950-69. These data are given by layers from the surface to 400 mb from twice-daily observations. (NOAA)
W80-00698

EXTENSION OF RIVER FLOW RECORDS IN ARGENTINA FROM LONG TREE-RING CHRONOLOGIES,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
For primary bibliographic entry see Field 2E.
W80-00731

SECULAR TREND IN EXTREME RAINFALLS,
Scientific and Education Administration, Beltsville, MD. Hydrology Lab.
D. M. Hershfield.
Journal of Applied Meteorology, Vol. 18, No. 8, p 1078-1081, August 1979. 2 fig, 4 ref.

Descriptors: *Rainfall, *Precipitation excess, *Statistics, Precipitation(Atmospheric), Data processing, Analytical techniques, Statistical methods, Frequency, Meteorology, Extreme rainfalls, Secular trends, Return periods.

Increasing attention has recently been given to many facets of climate change. This study focused on a possible trend in extreme rainfalls in the past two decades based on the records of 135 National Weather Service stations in the eastern United States. The standard used to compare the recent data was Weather Bureau Technical Paper No. 40. The two frequencies examined were the 2- and 100-year 24 h return periods. No trend was discernible. (Sims-ISWS)
W80-00735

SILVER CONCENTRATION IN RAINWATER FROM SEEDED AND NONSEEDED FLORIDA CUMULI: 1973-1975 RESULTS,
MITRE Corp., McLean, VA.
J. Wisniewski, and R. I. Sax.
Journal of Applied Meteorology, Vol. 18, No. 8, p 1044-1055, August 1979. 5 fig, 7 tab, 33 ref. NSF AEN75-19817, DES74-18536.

Descriptors: *Cloud seeding, *Rainfall, *Silver iodide, *Florida, Sampling, Chemical analysis, Weather modification, Rain water, Air circulation, Winds, Data collections, Aircraft, Analytical techniques, Weather, Meteorology, *Silver concentration.

The main objective of the Florida Area Cumulus Experiments was to seed groups of supercooled tropical cumulus clouds to convert enough water to ice so that sufficient heat could be released to enhance cloud growth and augment rainfall over a specific south Florida target area. During three consecutive summers (1973-75), subprograms to monitor the rainwater silver concentrations were conducted. Results showed that rainwater silver concentrations can be detected in significantly higher concentrations in seeded vs nonseeded samples with a carefully positioned network and with precise care in the preparation, collection, handling, storage, and analysis of the samples. In addition, the silver concentrations in the seeded rainwater samples were low enough to present no ecological or environmental problems whatsoever under the present seeding rates in south Florida. Stratification of the rainwater silver concentrations, using two different trajectory techniques, showed silver concentrations collected under continental influenced regimes to be almost identical to those collected under seeding conditions. This is a crucial result since, if rainwater silver concentrations are being used to determine whether the seeding material is being targeted in the optimum areas for maximum seeding efficiency, then the results may be biased under these continental influenced regimes. (Sims-ISWS)
W80-00736

RAINFALL INTERCEPTION BY EIGHT SMALL TREES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 2I.
W80-00744

2C. Snow, Ice, and Frost

GLACIOLOGICAL DATA: WORKSHOP ON SNOW COVER AND SEA ICE DATA.
Colorado University, Boulder, Institute of Arctic and Alpine Research. Report GD-5, May 1979. 127 p, 28 fig, 10 tab, 162 ref, 1 append.

Descriptors: *Conferences, *Snow, *Ice, *Sea ice, *Glaciology, *Arctic, Data collections, Climatolo-

gy, Meteorology, Hydrology, Oceanography, Water resources, Satellites(Artificial), Mapping, River basins, Monitoring.

Under a NOAA/EDIS contract, the Data Center is preparing an inventory of snow cover and sea ice data. The primary focus to date has been on map series and other data products describing cryospheric parameters on a regional to global scale. As part of this endeavor, the WDC arranged a two-day workshop of agency representatives and interested scientists in Boulder, 2-3 November 1978, on The Mapping and Archiving of Data on Snow Cover and Sea Ice Limits. While the attendees, with one exception, were from North America, the workshop recommendations and the material presented here are of broad relevance to problems of worldwide concern in the environmental sciences, especially climatology, meteorology, hydrology, and oceanography. This issue contained the workshop recommendations and papers (or summaries). (See W80-00567 thru W80-00578) (Froehlich-ISWS)
W80-00566

SNOW AND ICE DATA SETS FOR CLIMATE AND WATER RESOURCE STUDIES WITH PARTICULAR REFERENCE TO NORTH AMERICA,
National Center for Atmospheric Research, Boulder, CO.
R. L. Jenne, R. G. Crane, and P. K. MacKinnon.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 7-23, May 1979. 3 fig, 1 tab, 62 ref, 1 append.

Descriptors: *Snow, *Ice, *Glaciology, *Documentation, *North America, Bibliographies, Water resources, Data collections, Information retrieval, Publications, Weather data, Sea ice, Maps, Hydrologic aspects, *USSR, Data sources.

The paper focused on sources of snow and ice data sets, snow and ice gridded data products, and related hydrometeorological data. Major data sets on snow cover and sea ice, including the results of both historical and current surveys, are held at the World Data Center A for Glaciology (Snow and Ice), which is colocated with the National Geophysical and Solar Terrestrial Data Center in Boulder, Colorado. Archives of climatological data exist in national and international repositories. In the United States, the NOAA Environmental Data and Information Service operates the National Climatic Center (NCC). This is the central U.S. repository for atmospheric data. At the operational level, the National Weather Service is responsible for collecting and assessing real-time data. At the international level, the World Meteorological Organization (WMO), a United Nations agency, in collaboration with the International Council of Scientific Unions, supports world data centers for climatological data. In conjunction with the WMO-established Global Telecommunications System (GTS), meteorological data are channeled to the World Data Centers for Meteorology: A in Asheville, North Carolina; B in Moscow, USSR; and C in Melbourne, Australia. Each data center archives various global data sets. In the United States, NCC also maintains an extensive inventory on GTS-sampled data. (See also W80-00566) (Humphreys-ISWS)
W80-00567

DATA SOURCES AND SEA ICE PRODUCTS OF FLEET WEATHER FACILITY/JOINT ICE CENTER, SUITLAND,
Fleet Weather Facility, Suitland, MD.
R. H. Godin.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 29-35, May 1979. 3 fig, 8 ref.

Descriptors: *Sea ice, *Data collections, *Maps, *Forecasting, Analysis, Surveys, Analytical techniques, Climatology, Cold regions, Arctic, Data sources.

This paper was developed to systematically describe and explain data sources, method of production, and products of the weekly sea ice analysis program. Manually analyzed Eastern and Western Arctic Sea Ice Charts are produced weekly as a synthesis of ice data and satellite information of varying resolution and utility. Seven-day ice limit forecasts reflect anticipated trends. The forecast is intended to depict anticipated trends in ice limit positions. Available guidance is in the form of automated 144-hour wind/current ice vector forecasts at 207 Arctic grid point locations and the application of persistence, extrapolative, and climatological ice movement rates. Diagnostic aids involving positive and negative degree-day accumulations and station temperature summaries are also considered. Compilations of weekly ice analyses are bound into a book format and are available from the National Technical Information Service in microfiche or hard copy form. (See also W80-00566) (Humphreys-ISWS)
W80-00568

MAPPING AND ARCHIVING OF CANADIAN SEA ICE DATA,
Atmospheric Environment Service, Downsview (Ontario).
For primary bibliographic entry see Field 7C.
W80-00569

A DMSP NEAR IR SENSOR FOR CLOUD/SNOW DISCRIMINATION,
Westinghouse Electric Corp., Baltimore, MD.
For primary bibliographic entry see Field 7B.
W80-00570

THE UNITED STATES ENVIRONMENTAL SATELLITE DATA ARCHIVES,
National Climatic Center, Asheville, NC.
For primary bibliographic entry see Field 7B.
W80-00571

SATELLITE-DERIVED RIVER BASIN SNOW-COVER PERCENTAGES: A NEW DATA BASE FOR HYDROLOGISTS,
National Environmental Satellite Service. Washington, DC.
For primary bibliographic entry see Field 7B.
W80-00572

LANDSAT-DERIVED SNOW COVER AS A FORECAST TOOL IN THE RIO GRANDE BASIN IN COLORADO,
Soil Conservation Service, Denver, CO.
B. A. Shafer.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 61-69, May 1979. 6 fig, 5 ref.

Descriptors: *Snow cover, *Watersheds(Basins), *Colorado, *Rio Grande River, Remote sensing, Snow surveys, Satellites(Artificial), Forecasting, Snowmelt, On-site investigations, Areal, Flood forecasting, Streamflow forecasting, Methodology, Snow, Mapping, LANDSAT.

The study approach involved a four-step analysis: (1) to identify specific drainage basins and acquire the Landsat imagery to cover them; (2) to examine various techniques of mapping the snow cover and determine which method is most useful in an operational mode; (3) to develop a methodology for including snow-covered area in a forecast of snowmelt runoff; and, (4) to evaluate the adequacy of the forecasting techniques which employed snow cover. Use of snow areal extent measurements in snowmelt runoff prediction in the Rio Grande shows promise, but with the short period which the study encompassed, it is difficult to assess its long-range impact. Currently (1978) available Landsat imagery is of sufficient quality and resolution for accurate snow mapping by photo interpretative means. Delay in image delivery, occurrence of cloud cover, and a 9-day interval between satellite coverage diminish to a significant extent the amount of reliance one can place in using snow cover as a forecast parameter. Three methods of using snow cover area in forecasting have been explored and have proven successful. A statistical regression model relates snow cover to season volume flow directly. An empirical method relates seasonal snowpack depletion to seasonal and annual yields. A computerized simulation model provides short-term and seasonal forecasts using snow cover as an input variable. (See also W80-00566) (Humphreys-ISWS)
W80-00573

ARCHIVING AND MAPPING OF CANADIAN SNOW COVER DATA,
Atmospheric Environment Service, Downsview (Ontario).
B. F. Findlay, and B. E. Goodison.
In: Glaciological Data; Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 71-87, May 1979. 7 fig, 2 tab, 20 ref.

Descriptors: *Snow cover, *Canada, *Mapping, *Data storage and retrieval, Maps, Hydrologic aspects, Areal, Data processing, Data collections, Snowfall, Surveys, Snow surveys, Ice, Water equivalent, Publications, On-site data collections, Remote sensing, Measurement.

The snow resource is documented for quantity, distribution, and timing by networks of meteorological observing stations and snow courses operated by public and private agencies. Archiving makes widespread use of computer compatible methods, but some smaller agencies continue to rely on hand tabulation. This paper presented an overview of these procedures and practices but concentrated on the activities of the Atmospheric Environment Service as a lead agency in the collecting, processing, publishing, and preserving of national snow cover information. (See also W80-00566) (Humphreys-ISWS)
W80-00574

ACCURACY OF SNOW AND ICE MONITORING,
Lamont-Doherty Geological Observatory, Palisades, NY.
G. Kukla, and D. Robinson
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 91-97, May 1979. 2 fig, 3 tab, 8 ref. NSF ATM77-28522.

Descriptors: *Snow cover, *Monitoring, *Ice cover, *United States, Analytical techniques, Analysis, Data collections, Maps, Mapping, Distribution, Areal

In order to examine the accuracy of the operational snow charts, the authors produced a new, independent, updated set of snow maps for three selected blocks in the United States. Satellite information for each day was recharted and completed by incorporating reports from the ground stations. Given the frequently irregular and sketchy character of the snow fields, the difficulties in distinguishing snow in heavily forested areas, and the rapid changes of snow cover in the selected intervals, the accuracy of the charts was considered to be sufficiently high for climate-related studies on a continental or hemispheric scale. The Navy and NESS operational charts of sea ice covers were checked using a method similar to that used in the snow map analyses. Results will be reported in more detail elsewhere. In general, the quality of both sets was found to be sufficiently high for use in climate-related studies. Suggestions for future snow and ice map products: (1) A minimum scale of 1:30,000 is needed. (2) Reflectivity classes should be more detailed, at least 6 classes. (Brightness data are preferable to snow depth for the purposes of climate dynamic studies.) (3) Charts should distinguish between data recorded on the day that the chart is dated and data collected on previous days. (4) The proportion of snow to bare ground should be given where possible. (5) Where possible, areas of melting snow cover on the pack ice should be indicated. (6) Where possible, relative reflectivity of sea ice should be indicated in Navy charts. (See also W80-00566) (Humphreys-ISWS)
W80-00575

AN ARCTIC SEA ICE DATA SET, 1901-1956,
University of East Anglia, Norwich (England). Climate Research Unit.
P. M. Kelly.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 101-106, May 1979. 1 fig, 1 tab, 25 ref, 1 append. ONR N00014-77-G-0074.

Descriptors: *Sea ice, *Data processing, *Data collections, *Arctic, Data storage and retrieval, Analytical techniques, Analysis, Distribution, Areal.

The Climatic Research Unit, University of East Anglia, is engaged in a feasibility study of the potential for Arctic sea ice prediction on climatic time scales. The main stages in this research were summarized in an appendix. The program includes the collection of sea ice data for the Arctic covering the 20th century; the statistical analysis of these data to identify the major fluctuations in sea ice extent, both spatially and temporally; correlation with climatic and atmospheric circulation data to determine the immediate causes of these sea ice variations, not excluding the possibility of feedback; and research, both theoretical and empirical, aimed at achieving the degree of understanding of the causes of these variations in climate and sea ice which is a necessary prerequisite to any predictive effort. This paper dealt with the first stage in this research: the collection of Arctic sea ice data for the 20th century. (See also W80-00566) (Humphreys-ISWS)
W80-00576

INADEQUACIES IN ARCHIVED SEA ICE DATA,
Sea Ice Consultants, Camp Springs, MD.
W. S. Dehn.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 107-108, May 1979.

Descriptors: *Sea ice, *Data collections, *Data processing, *Arctic, On-site data collections, Ice, Distribution, Areal, Inadequate data.

This paper primarily emphasized correctable inadequacies existent in today's (1978) processing and use of sea ice data. The examples presented were examples of mistakes in plotting data, ineptness in the interpretation of satellite imagery, failure to incorporate other data, and a failure to maintain continuity and a constant watch on changing conditions. In the cases presented, an understanding of sea ice distribution and the meteorological/oceanographic influences, combined with a constant watch, the use of all possible data sources, and the exercise of quality control could have prevented the inadequacies. The three examples presented were: (1) One of the most dramatic short-term changes in the extent of sea ice occurred in the Bering Sea during the period from 4 March to 8 March 1970. During that period, the Bering Sea ice pack expanded some 330 km southward over a 72-hour period. This expansion was a result of freezing (formation of new ice) and ice drift. (2) During April and May of 1970, nearly 550 km of existing ice east of Greenland was not documented. The failure to record this was a matter of lack of understanding of sea ice distribution, ineptness in interpreting satellite imagery, a failure to maintain a watch on the ice edge, and a failure to incorporate foreign data. (3) Data from aerial ice reconnaissance conducted during early October 1959 were plotted in error and accepted by ice forecasters. The author concluded that personnel involved in compiling historical sea ice data should understand sea ice distribution and the influencing meteorological/oceanographic parameters, use all possible data sources, and exercise quality control. (See also W80-00566) (Humphreys-ISWS)
W80-00577

NASA MAPPING PROJECTS (SUMMARY),
National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD.
For primary bibliographic entry see Field 7C.
W80-00578

SEA ICE RIDGING OVER THE ALASKAN CONTINENTAL SHELF,
Army Terrestrial Sciences Center, Hanover, NH.
W. B. Tucker, III, W. F. Weeks, and M. Frank.
Journal of Geophysical Research, Vol. 84, No. C8, p 4885-4897, August 20, 1979. 13 fig, 1 tab, 24 ref.

Descriptors: *Sea ice, *Continental shelf, *Alaska, Remote sensing, Data collections, Aircraft, Data processing, Model studies, Mathematical models, Ice, Oceans, Arctic, Analytical techniques, Sea ice ridging, Ridge heights, Laser profilometer data.

Sea ice ridging statistics obtained from a series of laser surface roughness profiles were examined. Each set of profiles consisted of six 200-km long flight tracks oriented approximately perpendicular to the coastline of the Chukchi and Beaufort seas. The landward ends of the profiles were located at Point Lay, Wainwright, Barrow, Lonely, Cross Island, and Barter Island. The flights were made in February, April, August, and December 1976, and one additional profile was obtained north of Cross Island during March 1978. It was found that although there is a systematic variation in mean ridge height with season, with the highest values occurring in late winter, there is no systematic spatial variation in ridge height at a given time. The number of ridges/km (mu) also are high during the late winter, with the highest values occurring in the Barter Island and Cross Island profiles. In most profiles, the ice 20-60 km from the coast is more highly deformed (higher mu values) than the ice either nearer the coast or farther seaward. The Wadhams model for the distribution of ridge heights gives better agreement with observed values in the higher ridge categories than does the Hibler model. Estimates of the spatial recurrence frequency of large pressure ridges were made by using the Wadhams model and also by using an extreme value approach. In the latter, the distribution of the largest ridges per 20 km of laser track was found to be essentially normal. Wadhams' distribution consistently predicts slightly larger ridge sails than does the extreme value approach. The main factors currently limiting the accurate prediction of the temporal recurrence of large pressure ridges are limited knowledge of the drift of near-shore ice and data that would permit the assessment of year to year variability in mu. (Sims-ISWS)
W80-00738

ULTRASONIC VELOCITY INVESTIGATIONS OF CRYSTAL ANISOTROPY IN DEEP ICE CORES FROM ANTARCTICA,
Army Terrestrial Sciences Center, Hanover, NH.
H. Kohnen, and A. J. Gow.
Journal of Geophysical Research, Vol. 84, No. C8, p 4865-4874, August 20, 1979. 12 fig, 1 tab, 22 ref. NSF DPP76-18401.

Descriptors: *Ice, *Crystals, *Antarctic, Laboratory tests, Analytical techniques, Ultrasonics, Density, Anisotropy, Velocity, Glaciers, Cores, Glaciology, Rheology, Crystal anisotropy, Ice sheets.

Ice cores from Byrd Station and Little America V were used to test an ultrasonic technique for evaluating crystal anisotropy in the Antarctic Ice Sheet. P wave velocities measured parallel and perpendicular to the vertical axes of cores from the 2164-m-thick ice sheet at Byrd Station yielded results in excellent agreement with the observed c axis fabric profile and with the in situ P wave velocity profile measured parallel to the borehole axis. Velocity differences of Delta V in excess of 140 m/s for core samples from deeper than 1300 m attest to the strong single-pole clustering of crystallographic c axes about the vertical, especially in the zone from 1300 to 1800 m. Such oriented structure is compatible only with strong horizontal shearing in this zone. The existence in an ice sheet of widespread shearing several hundred meters above its bed raises serious questions as to the validity of current concepts of the flow of large ice masses that tend to gloss over or ignore crystal alignments of this magnitude. In ice cores from the bottom 350 m at Byrd Station, the crystals are so large (up to 30 sq cm in cross-sectional area) that samples used for ultrasonic measurements usually contained too few crystals to yield fully reliable Delta V data. It was determined that a sample should contain at least 50 crystals if velocity bias resulting from group clustering of c axes in coarse-grained ice is to be avoided. (Sims-ISWS)
W80-00739

2D. Evaporation and Transpiration

HEAT AND MASS EXCHANGE COEFFICIENTS FOR OPEN WATER SURFACES,
Institute of Meteorology and Water Management, Warsaw (Poland).
D. Jurak.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 161-169, 1978. 2 tab, 7 ref.

Descriptors: *Heat balance, *Mathematical models, *Reservoirs, *Evaporation, Boundary processes, Surface waters, Air-water interfaces, Model studies, Heat budget, Water temperature, Analytical techniques, Theoretical analysis, Equations, Cooling, Heating, Thermal models.

By applying the square approximation of the total heat losses from the water temperature, new formulas were worked out for the evaluation of the heat exchange coefficients between the water surface and the atmosphere, heat losses and evaporation from the water surface of natural reservoirs, and those influenced by thermal discharges. Methods presented for the evaluation of the heat budget components and heat exchange between the water surface and the atmosphere were based on data from standard meteorological networks, and they can be applied in thermal models in order to predict water temperature and evaporation from existing and planned reservoirs. The proposed method is applicable for monthly as well as daily intervals, and the differences in determining heat losses and evaporation do not exceed + or -15 %. (See also W79-00379) (Humphreys-ISWS)
W80-00714

PREDICTING HYSTERETIC EFFECTS IN EVAPORATION FROM BARE SOIL,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
W. J. Staple.
Soil Science Society of America Journal, Vol. 43, No. 4, p 769-772, July-August 1979. 4 fig, 10 ref.

Descriptors: *Evaporation, *Soils, *Rainfall, Model studies, Drying, Simulated rainfall, Hysteresis, Wetting, Infiltration, Forecasting, Water conservation, *Wetting potential, *Dry soil, Soil water pressure, Redistribution, Drying potential, Scanning curves, Hysteretic effect.

Evaporation losses from initially dry soil moistened by simulated rainfall were computed on the assumption that the soil water pressure on drying was uniquely predicted by either the wetting or drying boundary curve of the hysteresis function. That is, hysteretic effects involving detailed drying scanning curves were neglected. The results showed that computed evaporation losses based on the two unique curves were nearly equal, and that these losses were only about 1/2 of those established previously both by evaporation measurement and by computations based on the appropriate scanning curves. It was concluded that hysteretic effects could not be neglected or estimated by a simple averaging procedure in predicting water conservation in summerfallow under semiarid conditions. (Roberts-ISWS)
W80-00732

2E. Streamflow and Runoff

HYDROLOGICAL FORECASTING FOR OPERATIONAL PLANNING AND MANAGEMENT OF WATER RESOURCES,
E. G. Popov.

In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2219-2228.

Descriptors: *Forecasting, *Planning, *Water management, *River flow, *Snowmelt, *Multiple-purpose reservoirs, Methodology, Hydrology, Water resources, Mountain rivers, Rivers, Meteorology, Precipitation(Atmospheric), Snow cover, Flood forecasting, Soviet Union, Reservoirs, Hydroelectric power, Navigation, Seasonal, Streamflow, Groundwater, Frequency.

Hydrological forecasting is necessary for optimal use of water resources, especially in relation to multipurpose streamflow storage reservoirs. Long-term forecasts (up to 12 mo in advance) are needed for optimal planning of: (1) electric power generation, (2) cropland management, (3) water distribution for irrigation, and (4) streamflow regulation for agriculture, fisheries, water supply, and inland navigation. In the Soviet Union 60-70% of seasonal runoff in many rivers depends on snowmelt, 90% in mountainous regions with dry summers. In peak years snowmelt flood flow can be 10 times greater than in the minimum year. Forecasts of river discharges and stages for the low-flow period when groundwater is the main source of river feed are also of great importance for operation of hydroelectric plants and reservoirs, navigation, and water supply projects. Such forecasts are issued 1-3 mo in advance. Long-range forecasts of snowmelt flood flow of lowland rivers are based on empirical relationships between seasonal snowmelt runoff and: (1) the water equivalent of snow cover before melting, (2) precipitation after melting begins, and (3) soil moisture factors. Such forecasts are within 20% of actual flow in 75-95% of cases. Forecasts of seasonal snowmelt flow for mountain rivers is based on snow storage in the mountains; 70-80% of forecasts are within 20% of real values. Low-flow forecasts, based on laws of water storage depletion in river basins, are more reliable where precipitation is relatively less important in flow formation. (Lynch-Wisconsin)
W80-00467

DISPERSION AND IMPACT OF MOBILE RIVER SYSTEM WATERS IN MOBILE BAY, ALABAMA,
Alabama Univ., Dauphin Island. Dauphin Island Sea Lab.
W. W. Schroeder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102981, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Auburn University, Bulltin 37, August, 1979, 48 p, 20 fig, 3 tab. OWRT A-058-ALA(2), 14-34-0001-8001.

Descriptors: *Discharge rates, Salinity, Wind, Tide, Dispersion, Mixing, Mobile River, Mobile Bay.

Twenty-two field surveys, carried out between November, 1976, and September, 1978, are used to characterize the dispersion and impact of Mobile River System waters in Mobile Bay, Alabama. River discharge rates ranged from 7-day average low flows of < 400 cubic m sec-1, to a 5-year frequency flood of approx. 9,200 cubic m sec-1. These discharges serve as a simple source of fresh water at one extreme to a dominant role at the other extreme, rendering the majority of the bay a near lemnetic system. Salinity patterns that are longitudinally, laterally and vertically variable result from the mixing of river waters with bay waters. The configuration of the bay, local winds and astronomical tides are shown to play key modifying roles.
W80-00491

FLOOD HAZARD ANALYSES, LITTLE OSSIPEE RIVER, TOWNS OF ACTON, NEWFIELD AND SHAPLEIGH, MAINE, YORK COUNTY.
Soil Conservation Service, Orono, ME.
September 1977. 6 p, 8 fig, 8 plates, 1 tab.

Descriptors: *Maine, *Floods, *Historic floods, *Flood data, *Flood stages, *Peak discharge, *Stage-discharge relations, *Acton(ME), *Newfield(ME), *Shapleigh(ME), *Little Ossipee River(ME), Regional flood, Indirect flood measurement, Flood profiles, Rivers, Flood plains, Flood protection, Flood plain insurance, 100-year flood, 500-year flood.

This report identifies and delineates the flood hazard areas along 11 miles of the Little Ossipee River in York County in southern Maine. Drainage area of the study reach is about 185 miles. Flood plain width varies from 500 feet up to a maximum of 1000 feet. Development in the flood plain includes several small towns and recreation areas. No dwellings presently exist in the 100-year flood plain. However, development pressure in the flood plain is projected to take the form of construction of both permanent and seasonal homes in the next four to five years. Streamflow data were gathered from a U.S. Geological Survey gaging station (with a period of record of 36 years) on the Little Ossipee near its mouth at South Limington. Flooding is caused mainly by spring snowmelt and by brief but intense summer rains. Major flooding occurred on the river in March 1936, with a peak discharge of 8,530 cubic feet per second (cfs) downstream of the study area; the highest recorded discharge at the gage on the Little Ossipee River occurred in May 1954 and measured 5,300 cfs. Peak discharge estimates for the 100- and 500-year flood occurrences are 2,970 cfs and 4,690 cfs, respectively, at Newfield Road. This report is intended to provide a technical basis for flood plain management; suggestions include land use planning, flood plain regulation and acquisition, and conservation easements. (Arnold-NC)
W80-00535

FLOOD PLAIN INFORMATION: BAYOU BONFOUCA-BAYOU VINCENT W-14 MAIN DIVERSION CANAL DOUBLOON BRANCH-FRENCH BRANCH, SLIDELL, LOUISIANA AND VICINITY,
Army Engineer District, New Orleans, LA.
Prepared for St. Tammany Parish Police Jury and the St. Tammany Parish Department of Planning and Engineering, Louisiana, December 1971. 54 p, 18 fig, 19 plates, 14 tab.

Descriptors: *Louisiana, *Floods, *Flood profiles, *Storms, *Hurricanes, *Flood stages, *Bayou Bonfouca(LA), Bayou Vincent(LA), *Doubloon Branch(LA), *French Branch(LA), *Slidell(LA), Overland flow, Flooding, Overflow, Indirect flood measurement, Historic floods, Flood data, Peak discharges, Flow duration, Rivers, Standard project flood, W-14 Main Diversion Canal(LA), St. Tammany Parish(LA), Intermediate regional flood.

The study area in the immediate vicinity of Slidell, Louisiana, is part of an ancient delta of the Mississippi River with elevations ranging from a few feet above mean sea level (msl), at its southern limit near Lake Pontchartrain, to approximately 20 feet msl at its northern limits, above the city of Slidell at Interstate Highway 1-12. There are three major stream and canal systems draining the study area, Bayou Vincent (W-13 Main), W-14 Main (locally known asthe Diversion Canal), and Doubloon Branch-French Branch (W-15 Main). The watershed of these three systems is 127 square miles and development in this area ranges from industrial to rural and undeveloped. The study area is subject to flooding from hurricane surges as well as headwater flooding from the various streams in the area. There are very few flood records in the study area; information was gathered through interviews newspaper files and historical documents. The greatest flood occurred on May 18, 1958 when 13.20 inches of rain was recorded in Slidell. The Intermediate Regional Flood (IRF) at the mouth of Bayou Vincent would discharge 7,700 cubic feet per second (cfs), while the Standard Project Flood (SPF) would discharge 11,000 cfs. Duration for headwater or rainfall flooding varies from 20 to 36 hours for the IRF and SPF, respectively, while duration of hurricane flooding is estimated to be 35 hours. There are no existing comprehensive flood control projects that would benefit the entire watershed. There is one project under construction that will reduce hurricane flooding. (Iervolino-NC)
W80-00536

FLOOD PLAIN INFORMATION: OHIO RIVER, HANCOCK COUNTY, KENTUCKY,
Army Engineer District, Louisville, KY.
Prepared for Hancock County Fiscal Court, KY. August 1971. 31 p, 10 fig, 15 plates, 7 tab.

Descriptors: *Kentucky, *Flooding, *Stage-discharge relations, *Hancock County(KY), *Ohio River(KY), Floods, Indirect flood measurement, Maximum probable flood, Flood profiles, Historic floods, Flood data, Flood frequency, Flood stages, Flood peak, Flow duration, Flood damage, Flood protection, Warning systems, Levee, Reservoirs, Intermediate regional flood, Project design flood, Hawesville(KY), Lewisport(KY).

This study relates to flooding of the Ohio River in Hancock County, Kentucky, a distance of approximately 30 miles. Hancock County has a land area of 187 square miles and a 1970 population of 7,080 The majority of flood plain developments are agricultural with some residential development primarily consisteing of the towns of Lewisport and Hawesville. Flood data were collected from U.S. Weather Bureau gages, stream gage records, newspaper accounts of past floods, and historical records and investigations. There are at present no flood plain zoning regulations covering all of Hancock County and only a levee protecting Hawesville has been constructed. The main flood season for the Ohio River is winter and early spring. Most of the flooding is due to heavy rains. The worst flood in Hancock County occurred in January 1937, reaching an elevation of 405.4 feet at Hawesville and 398.8 feet at Lewisport, inundating large portions of both towns. The intermediate Regional Flood would reach a height of 398.95 feet at the Tell City gage. This report provides the basis for further investigations and planning on the part of local governments in arriving at solutions to minimize vulnerability to flood damages. (Coan-NC)
W80-00537

SPECIAL FLOOD HAZARD INFORMATION REPORT: TYGART RIVER, TAYLOR COUNTY, WEST VIRGINIA,
Army Engineer District, Pittsburgh, PA.
Prepared for the Region VI Planning and Development Council, Taylor County Commission, City of Grafton, West Virginia Department of Natural Resources, November 1978. 5 p, 3 tab, 8 plates.

Descriptors: *West Virginia, *Flood forecasting, *Flood profiles, *Flood data, *Flood frequency, *Tygart River(WV), *Tygart Dam(WV), Floods, Flooding, River forecasting, Historic floods, Flood stages, Peak discharges, Flood protection, Dams, Grafton(WV), Park View(WV), Fetterman(WV), 100-year flood, 500-year flood.

This report describes the flood situation along a 20 mile segment of the Tygart River in Taylor County, West Virginia. The flood plain in the study area is relatively narrow; development within the flood plain is residential, commercial and industrial, and is centered around Park View, Grafton and Fetterman. The Tygart Dam, located above Grafton, serves as a flood reduction measure. Data were obtained from stream gages located within and below the study area. Prior to construction of the Tygart Dam in 1938, the highest recorded flood in Taylor County crested at 987 feet above National Geodetic Vertical Datum (NGVD) of 1929, with a discharge of 74,300 cubic feet per second (cfs). No major floods have occurred in Taylor County since completion of the dam. Below the study reach, the greatest flood occurred in 1948, cresting at 873.2 feet above NGVD and discharging 22,500 cfs. At the USGS gage at Carr China at the Tygart outflow, the 100-year flood would crest at 982.30 feet above NGVD, discharging 30,000 cfs, and the 500-year flood would crest at 993.25 feet above NGVD, discharging 70,000 cfs. The report includes high-water profiles and maps showing previously flooded areas along the river. The purpose of this report is to aid in determining flood heights and areas subject to flooding, and is intended to be used as a planning tool for local developers and

planning agencies. In addition, this report is to serve as a basis for further study of flooding on the identified distance of the river. (Iervolino)-NC)
W80-00538

FLOOD PLAIN INFORMATION: OHIO RIVER, BOONE COUNTY, KENTUCKY,
Army Engineer District, Louisville, KY.
Prepared for Boone County Fiscal Court, KY. (1972) 32 p, 11 fig, 16 plates, 6 tab.

Descriptors: *Kentucky, *Flooding, *Stage-discharge relations, *Boone County(KY), *Ohio River(KY), Floods, Indirect flood measurement, Flood profiles, Historic floods, Flood data, Flood frequency, Flood recurrence interval, Flood stages, Peak discharge, Flood peak, Flow duration, Flow characteristics, Flood protection, Warning systems, Intermediate Regional Flood, Project design flood.

This study relates to flooding of the Ohio River in Boone County, Kentucky, a distance of 39.1 miles. Developments in the study area include residential, commercial and industrial facilities. Completion of the Markland Dam, with resultant improvement in commercial navigation facilities and enhancement of recreation potential, has stimulated growth along the riverfront. Flood data were collected from a U.S. Geological Survey stream gage, newspaper accounts, and historic records. Flood damage prevention measures include the upstream Ohio River tributary flood control reservoirs but within the county there are no flood protection works or flood plain regulations. The main flood season for the Ohio River occurs from Jauary to April resulting from general heavy rains. The worst recorded flood in Boone County occurred in January 1937, reaching a height of 508.1 feet and dischaging 894,000 cubic feet per second (cfs). The sustained flood period was 17.5 days, with a water velocity of 6.0 feet per second. The intermediate Regional Flood would reach the same elevation as the historic 1945 flood, which was 497.3 feet with a discharge of 708,000 cfs. This report provides the basic information to allow local governments to minimize vulnerability to flood damages. (Coan-NC)
W80-00539

FLOOD PLAIN INFORMATION: BATON ROUGE, LOUISIANA, NO. 5, CYPRESS BAYOU AND TRIBUTARIES,
Army Engineer District, New Orleans, LA.
Prepared for City of Baton Rouge, LA, November 1976. 41 p, 20 fig, 23 plates, 6 tab.

Descriptors: *Louisiana, *Flooding, *Flood profiles, *Peak discharge, *Cypress Bayou(LA), Floods, Indirect flood measurement, Historic floods, Flood data, Flood frequency, Flood stages, Flood peak, Flow duration, Flow characteristics, State-discharge relations, Flood protection, Flood plain insurance, Warning systems, Building codes, Control structures, Channel improvement, Standard project flood, Intermediate regional flood, Comite River(LA), East Lateral(LA), West Lateral(LA), Baton Rouge(LA).

The study area covered in this report includes portions of East Baton Rouge Parish and Baker subject to flooding from the Comite River, Cypress Bayou and some of their tributaries. Developments in the flood plain of lower Cypress Bayou is semi-rural with a few subdivisions, while development in the flood plain of East Lateral, a tributary of Cypress Bayou, is becoming suburban. Flood data were collected from several stream gaging stations, newspaper files, and historical documents and records. Extensive channel improvements on the Comite River, Cypress Bayou, and East and West Laterals of Cypress Bayou have been made along with the institution of building codes to control flooding. The main flood season in the Cypress Bayou watershed occurs during the winter and spring. The worst recorded flood occurred in April 1967 but no discharge figures are available. The peak discharge for the Intermediate Regional Flood on the Comite River is 34,100 cubic feet per second (cfs), for Cypress Bayou, 7,310 cfs, for the East Lateral, 1,490 cfs. The Standard Project Flood peak discharge for these areas are 50,100 cfs, 9,520 cfs, and 1,650 cfs, respectively. This report provides a suitable basis for flood plain zoning decisions and future land use planning. (Coan)
W80-00540

FLOOD PLAIN INFORMATION: BATON ROUGE, LOUISIANA, NO 4, HURRICANE CREEK, MONTE SANO BAYOU AND TRIBUTARIES,
Army Engineer District, New Orleans, LA.
Prepared for City of Baton Rouge, LA, November 1976. 56 p, 28 fig, 41 plates, 6 tab.

Descriptors: *Louisiana, *Flooding, *Flood profiles, *Flood data, *Peak discharge, *Flood plains, *Baton Rouge(LA), *Hurricane Creek(LA), *Monte Sano Bayou(LA), Floods, Indirect flood measurement, Flood forecasting, Historic floods, Flood stages, Flood peak, Flow duration, Flow characteristics, Stage-discharge relations, Rivers, Flood protection, Flood plain zoning, Flood plain insurance, Warning systems, Building codes, Channel improvement, Standard project flood, Intermediate regional flood, Comite River(LA), Robert Canal(LA).

The study area includes the flood plains of Comite River, Hurricane Creek, and Monte Sano Bayou covering portions of East Baton Rouge. Developments in the flood plain area are both densely residential and commercial, and sparsely settled open space. Flood data were gathered from several U.S. Geological Survey stream gages, newspaper files and historical documents and records. Extensive channel improvements provide most of the flood protection with limited building codes and subdivision ordinances enacted. The main flood season in the Hurricane Creek and Monte Sano Bayou watersheds occurs during the winter and spring. Most of the severe floods result from general heavy rains but some floods in the summer result from intense local thunderstorms. The worst recorded flood in the study area occurred April 29, 1962 on the Comite River and reached an elevation of 44.9 feet mean sea level (msl) with a peak discharge of 20,900 cubic feet per second (cfs). The Intermediate Regional Flood (IRF) peak discharges for the Comite River and Hurricane Creek would be 34,100 cfs and 9,590 cfs, respectively. These floods are expected to reach a height of rise above bankfull of 4.6 feet for the Comite River and 7.0 feet for Hurricane Creek. The IRF peak discharge for Monte Sano Bayou would be 5,790 cfs, reaching a height of 11.9 feet above bankfull stage. The peak discharges for a Standard Project Flood (SPF) on the Comite River, Hurricane Creek and Monte Sano Bayou would be 50,100 cfs, 11,900 cfs, and 6,490 cfs, respectively, with heights above bankfull stage of 7.3 feet, 7.7 feet and 12.6 feet, respectively. This report provides a basis for land use planning and decisions concerning flood plain utilization. (Coan-NC)
W80-00541

GEOMORPHIC STUDY OF UPPER MISSISSIPPI RIVER,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Y. H. Chen, and D. B. Simons.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW3, Proceedings Paper 14778, p 313-328, August 1979. 7 fig, 1 tab, 6 ref, 2 append.

Descriptors: *Mississippi River, *Geomorphology, *Channel improvement, *Model studies, Mathematical models, Navigation, Rivers, Dams, Dikes, Dredging, Sedimentation, Planning, Inalnd waterways, Backwater, Hydraulics.

In order to estimate the effects of removal of snags hazardous to navigation and construction of dikes, revetment, and locks and dams on the river geomorphology, the past and present geomorphic features of the Upper Mississippi River were studied. The geomorphic features studied included: the river position, river surface area, island surface area, number of islands, riverbed surface area, surface widths, water depth, side channels, and riverbed elevations. The study results indicated that natural and man-induced activities in the last 150 yr have produced subtle changes in the river geomorphology. The low dike fields narrowed the river, created new islands and chutes, and enlarged old islands. Locks and dams have widened the river and increased the number of islands in the pools. It was concluded that 50 yr from now the river scene of the Upper Mississippi River will be essentially as it is today if no major man-made changes or natural events occur. (Sims-ISWS)
W80-00585

A STORAGE ROUTING MODEL BASED ON CATCHMENT GEOMORPHOLOGY,
Wollongong Univ. (Australia). Dept. of Civil Engineering.
M. J. Boyd, D. H. Pilgrim, and I. Cordery.
Journal of Hydrology, Vol. 42, No. 3/4, p 209-230, July 1979. 9 fig, 5 tab, 29 ref.

Descriptors: *Storage, *Routing, *Flood routing, *Model studies, Mathematical models, Rainfall, Excessive precipitation, Precipitation(Atmospheric), Runoff, Hydrographs, Unit hydrographs, Water storage, Drainage, Watersheds(Basins), Streamflow, Geomorphology, Hydrology.

A storage routing model which estimates the runoff hydrograph from a rainfall-excess hyetograph was developed. The model comprised storage elements, each of which represented a catchment sub-area, connected in the same arrangement as the stream network. Different storage elements were used to represent the sub-areas which simply translate rainfall excess to runoff and those which do this and also transmit flow from an upstream area. This model structure permitted the storage parameter of each element to be related to the geomorphological and hydrological characteristics of the catchment. Only one fitted parameter was used in the model; all others were directly related to the catchment and model structures. Initial model development was for linear catchment response which was then extended to the non-linear case. Measurements of catchment non-linearity refer to average values of lag and stream discharge, whereas the non-linear storage-routing equation refers to instantaneous values. The power relations for the two cases were shown to be similar. Application of the model to 10 catchments in eastern New South Wales with a wide range of areas and drainage patterns gave consistent relationships and accurate results. (Sims-ISWS)
W80-00590

SOME DIMENSIONAL CONSIDERATIONS IN THE UNIT HYDROGRAPH THEORY,
Technion-Israel Inst. of Tech., Haifa (Israel). Faculty of Civil Engineering.
M. H. Diskin.
Journal of Hydrology, Vol. 42, No. 3/4, p 199-208, July 1979. 1 fig, 2 tab, 1 append.

Descriptors: *Runoff, *Discharge(Water), *Unit hydrographs, *Model studies, Mathematical models, Rainfall, Excessive precipitation, Precipitation(Atmospheric), Hydrographs, Flow, Hydrology, Data processing, Analytical techniques, Dimensional considerations.

The definition of the unit hydrograph leads to two possible dimensions for its ordinates. They are either the dimension of discharge per unit depth (L sq/T) or that of specific discharge per unit depth (1/T). Depending on the units used, three types of unit hydrographs were identified. The first denoted by w was expressed in units of cu m/s/mm, the second denoted v was in units of cu m/s/sq km/mm, and the third denoted by u was in units of mm/h/mm, or 1/h. The relationships between the various unit hydrographs and the areas enclosed by each curve were outlined. The corresponding unit hydrographs in English units were: w sub e in units of cu ft/s/in, v sub e in cu ft/s/sq mi/in, or v sub a in cu ft/s/acre/in and u in units of in/h/in, or 1/h. The relationships between these various unit hydrographs and between them and those in the metric units were also presented. A relationship between the peak ordinate of the unit hydrograph

and the time to peak was derived by considering the area enclosed by each of the unit hydrographs considered. (Sims-ISWS)
W80-00591

INFLUENCE OF SURFACE ROUGHNESS AND CLOD SIZE AND STABILITY ON SOIL AND WATER LOSSES,
Science and Education Administration, Lafayette, IN.
For primary bibliographic entry see Field 2J.
W80-00593

NOTE ON THE DISTRIBUTION OF FLOOD MAXIMA FOR RANDOM SAMPLE SIZE,
Otago Univ., Dunedin (new Zealand). Dept. of Geography.
W. E. Bardsley, and B. F. J. Manly.
Journal of Hydrology, Vol. 42, No. 1/2, p 187-193, June 1979. 3 tab, 8 ref.

Descriptors: *Floods, *Sampling, *Flood flow, Flood data, Flood frequency, Flood peak, Maximum probable flood, Distribution patterns, Equations, Time, *Flood maxima, *Random sample size, Sample size distribution, Partial duration series, Fixed sample asymptote, Flood exceedances, Distribution function.

The largest flood events observed in fixed time intervals can be interpreted as the largest members of samples of variable size. Determination of the exact distribution of maxima is complicated by the requirement of an explicit expression for the sample size distribution and there are no simple asymptotic expressions for the maxima equivalent to the fixed sample size case. There is some practical value, therefore, in ascertaining situations where the random sample size effect can be disregarded. To this end, a method was given for calculating the maximum error involved in analyzing the flood maxima as if they represented the largest observations from samples of fixed size. If this error can be shown to be small, then the standard fixed sample techniques can be utilized. The method can be applied to obtain the exact maximum error for a specified sample size distribution or, alternatively, an estimate of this error can be obtained from an observed partial duration series. A general condition was established for the maxima from random sample size to tend toward a fixed sample asymptote as the mean sample size increases. (Roberts-ISWS)
W80-00611

AN ANALYSIS OF THE PROCESSES OF RIVER BANK EROSION,
Victoria Univ. of Manchester (England). Geography Div.
For primary bibliographic entry see Field 2J.
W80-00612

IMPORTANCE OF LAKE-RIVER INTERACTION ON SEASONAL PATTERNS IN THE GENERAL CIRCULATION OF KAMLOOPS LAKE, BRITISH COLUMBIA,
Department of the Environment, Vancouver (British Columbia). Inland Water Directorate.
For primary bibliographic entry see Field 2H.
W80-00631

ENVIRONMENTAL OBSERVATIONS OF A RIPARIAN ECOSYSTEM DURING FLOOD SEASON,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
W. J. Mitsch, W. Rust, A. Behnke, and L. Lai.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104540, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois, Urbana, Research Report 142. August 1979. 69 p, 19 fig, 6 tab, 11 ref, 2 append. OWRT A-099-ILL(1), 14-31-001-9015.

Descriptors: *Wetlands, Flooding, Sedimentation, Riparian ecosystems, *Floodplains.

Dynamics of floodplain wetlands along the Kankakee River in Northeastern Illinois were studied during the Spring flood season of 1979. The study involved hydrology, water chemistry and sedimentation measurements. The wetlands study areas were dominated by silver maple (Acer saccharinum) with river birch (Betula nigra), pin oak (Quercus palustris), America elm (Ulmus americana) and swamp white oak (Q. bicolor) as subdominants. The floodplain forest study site was inundated for 62 to 80 days, depending on location during March - May 1979. Flooding was determined to occur at a river discharge of 4000 to 4500 cfs and the floodplain forest was determined to be under water 66 percent of the years for at least 10 days since 1917. Flooding has not occurred at all in only five years during that period. Approximately 6.2 million cubic meters of water was stored in the entire wetland area, this representing 2.3 percent of the floodwater above bankfull discharge at a downstream location. Water quality during flooding indicated that few spatial patterns existed on different floodplain sites and no differences were seen in the floodplain and main channel water quality of the river. Groundwater showed increasing orthophosphates and decreasing nitrates after floodwater receded. Sedimentation plates placed on the floodplain prior to flooding collected an average of 590 g/sq m of sediments, representing a gross deposition of 4500 metric tons of sediments on the entire wetland area. No consistent spatial pattern of sediment deposition was noted.
W80-00691

THE BIOCENOTIC MODEL,
Landesanstalt fuer Umweltschutz Baden-Wurttenberg, Karlsruhe (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W80-00707

THE USE AND LIMITATIONS OF A TWO-DIMENSIONAL MIXING MODEL FOR RIVERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 5B.
W80-00708

STREAMFLOW GENERATION IN A FORESTED WATERSHED, NEW ZEALAND,
Forest Research Inst. Christchurch (New Zealand).
M. P. Mosley.
Water Resources Research, Vol. 15, No. 4, p 795-806, August 1979. 12 fig, 5 tab, 18 ref.

Descriptors: *Watersheds(Basins), *Forest watersheds, *Streamflow, Flow, Seepage, Dye concentrations, Hydrographs, Hydrology, Runoff, Runoff forecasting, *New Zealand, *Streamflow generation, Channel stormflow generation, Quickflow, Saturated hydraulic conductivity.

A 0.3028-ha watershed has been instrumented to monitor streamflow and subsurface flow through the soil mantle at a variety of topographic locations. The watershed is forested, with steep (35 deg) slopes and shallow (average 55 cm) soils on impermeable Old Man gravels. Data for a number of storms indicated that subsurface flow via 'macropores' (root channels, pipes) and seepage zones in the soil is the predominant mechanism of channel stormflow generation in storms with quickflows greater than about 1 mm. Subsurface flow from all parts of the watershed appears to contribute to stormflow even in very small storms (quickflow of the order of 3% of net precipitation). The saturated hydraulic conductivity of the soil matrix is not a limiting factor on the ability of subsurface flow to generate channel stormflow because dye tracer experiments demonstrate that water may move through macropores (particularly root channels) at rates 2 orders of magnitude greater. However, subsurface flow from lower slope areas contributes to delayed flow; cessation of subsurface flow and streamflow after a drought period is roughly coincident in time. In the study area it appears that streamflow is at almost all times dominated by subsurface flow and that runoff from partial and variable source areas contributes significant quantities of streamflow only during the rising limb of small (less than 1 mm of quickflow) flood hydrographs. (Lee-ISWS)
W80-00724

DRAINAGE NETWORK POWER,
Southampton Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 8E.
W80-00725

AN APPLICATION RUNOFF MODEL STRATEGY FOR UNGAGED WATERSHEDS,
Science and Education Administration, Athens, GA.
D. L. Chery, Jr., C. G. Clyde, and R. E. Smith.
Water Resources Bulletin, Vol. 15, No. 4, p 1126-1145, August 1979. 11 fig, 3 tab, 29 ref.

Descriptors: *Runoff, *Model studies, *Watersheds(Basins), Mathematical models, Costs, Cost comparisons, Computers, Flow, Surface runoff, Overland flow, Rainfall, Precipitation(Atmospheric), Rainfall-runoff relationships, Hydrology, *Kinematic watershed models.

Mathematical models for predicting watershed surface flow responses are available, most of which are elaborate nonlinear numerical surface and channel flow models linked with infiltration models. Such models may be used to make predictions for ungaged areas, assuming an acceptable fitting of the model to the topography and roughness of the real system. For some application purposes, these models are impractical because of their complexity and expensive computer solutions. A procedure was developed that uses a complex model of an ungaged area to derive a simpler parametric nonlinear system model for repetitious simulation with input sequences. The predicted flow outputs were obtained with the simpler model at significant savings of money and time. The procedures for constructing a complex kinematic model of a 40 acre (161,880 sq m) reference watershed and for deriving the simpler system model were outlined. The results of predictions from both models were compared with a selected set of measured events, all having essentially the same initial conditions. Peak discharges ranged from 3 to 118 cu ft/sec (0.085 to 3.34 cu m/sec), which included the largest event of record. The inherent limitations of lumped systems models were demonstrated, including the bias caused by their inability to model infiltration losses after rainfall ceases. Computer costs and times for the models were compared. The derived simple model has a cost advantage when repeated use of a model is required. Such an applications hydrologic model has an engineering tradeoff of reduced accuracy and lumping bias, but it is more economical for certain design purposes. (Sims-ISWS)
W80-00728

STATISTICAL TERMINOLOGY: DEFINITIONS AND INTERPRETATION FOR FLOOD PEAK ESTIMATION,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen.
Water Resources Bulletin, Vol. 15, No. 4, p 1106-1116, August 1979. 1 fig, 20 ref.

Descriptors: *Statistics, *Statistical methods, *Flood peak, *Estimating, Floods, Flood forecasting, Statistical models, Estimating equation, Mathematical models, Hydrology, *Statistical terminology.

Considerable effort is expended each year in making flood peak estimates at both gaged and ungaged sites. Many methods, both simplistic and complex, have been proposed for making such estimates. The hydrologist that must make an estimate at a particular site is interested in the accuracy of the estimate. Most methods are developed using either statistical analyses or analytical optimization schemes. While publications describing these methods often include some statistical measure of goodness-of-fit, the terminology often does

not provide the potential user with an idea of how accurate the estimate is. That is, statistical terminology often is not used properly, which may lead to a false sense of security. The use of the correct terminology will help potential users evaluate the usefulness of a proposed method and will provide a means of comparing different methods. This study provided definitions for terms often used in literature on flood peak estimation and provided an interpretation for these terms. Specific problems discussed included the use of arbitrary levels of significance in statistical tests of hypotheses, the identification of both random and systematic variation in estimates from hydrologic methods, and the difference between accuracy of model calibration and accuracy of prediction. (Sims-ISWS)
W80-00729

EXTENSION OF RIVER FLOW RECORDS IN ARGENTINA FROM LONG TREE-RING CHRONOLOGIES,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
R. L. Holmes, C. W. Stockton, and V. C. LaMarche, Jr.
Water Resources Bulletin, Vol. 15, No. 4, p 1081-1085, August 1979. 3 fig, 6 ref.

Descriptors: *River flow, *Dendrochronology, *Trees, *Coniferous trees, Correlation analysis, Stream gages, Flow, Streamflow, Rivers, Climates, Climatology, Foreign countries, Foreign research, *Argentina.

Tree-ring chronologies were derived from two coniferous species growing in the foothills of the Patagonian Andes of Argentina, using crossdating and standardization techniques developed by the Laboratory of Tree-Ring Research. Seven of these chronologies were selected, along with data from two long reliable gaging stations to reconstruct annual streamflow for two major rivers extending back to the year 1601. Calibration between tree-ring and river flow data was established using the multivariate technique of canonical analysis. Correlations of 0.73 were obtained between gaged and reconstructed flow for both rivers. These Andean conifers contain good climatic and hydrological information and tree-ring chronology, and calibration techniques are capable of extracting much of this information. (Sims-ISWS)
W80-00731

INFLUENCE OF TURBULENCE ON THE ACCURACY OF DISCHARGE MEASUREMENTS IN NATURAL STREAMFLOWS,
Institute of Civil and Construction Engineering, Split (Yugoslavia). Faculty of Civil Engineering.
O. Bonacci.
Journal of Hydrology, Vol. 42, No. 3/4, p 347-367, July 1979. 9 fig, 4 tab, 7 ref.

Descriptors: *Discharge(Water), *Runoff, *Turbulence, *Streamflow, Model studies, Mathematical models, Simulation analysis, On-site investigations, Measurement, Current meters, Flow, Variability, Fluctuations, Velocity, Hydrology, Measurement accuracy.

The objective of this study was to solve some basic and current problems in the field of practical hydrometry and hydrology. As a matter of fact, the basis of this study was that the problems have been theoretically dealt with, but the results have found practical application. The problem of current meter measurement of discharge in natural streamflows was analyzed as well as the effect of the turbulent fluctuations (pulsations) on the possible accuracy of results obtained by this kind of measurement. Employing the mathematical model based on the results of the velocity distribution in a vertical (as defined by Nikitin) simulation of discharge in a schematized open river flow was effected. By means of the analysis of variance, the influence of the following 4 factors on the measurement accuracy were estimated: (1) the number of velocity measurement points in a vertical; (2) the number of velocity measurement verticals; (3) the position of measurement points along the vertical; and (4) the position of verticals along the cross section. The optimum number of measurement verticals, their position in the cross section, as well as the number and position of the points for measuring the velocity by the current meter were defined. The effect of the possible accuracy of discharge estimations on the accuracy of defining the rating curve was also studied. The original, approximate procedure for estimating the upper limit of the absolute error in discharge measurements was also presented. (Sims-ISWS)
W80-00745

A DIMENSIONALLY HOMOGENEOUS AND STATISTICALLY OPTIMAL MODEL FOR PREDICTING MEAN ANNUAL FLOOD,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Human Settlements Developments.
S. T. Wong.
Journal of Hydrology, Vol. 42, No. 3/4, p 269-279, July 1979. 3 tab, 5 ref.

Descriptors: *Floods, *Flood forecasting, *Model studies, Mathematical models, Regression analysis, Humid areas, Watersheds(Basins), Rainfall, Precipitation(Atmospheric), Drainage, Streams, Streamflow, Hydrology, Principal components analysis.

A combination of dimensional analysis and principal components analysis was employed to deduce a dimensionally homogeneous and statistically optimal least-squares fit estimation equation for predicting mean annual flood in a humid region. Through the application of Buckingham's pi-theorem and principal components analysis, a least-squares fit estimation equation was finally derived. The model so deduced proved to be both dimensionally homogeneous and statistically optimal. The results yielded by the model were not only superior, but also they were more refined than those that were unfolded by an initial study made by the author. (Sims-ISWS)
W80-00747

A STATISTICAL METHOD FOR MODELLING THE FATE OF RAINFALL IN A TROPICAL RAINFOREST CATCHMENT,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geography.
M. Bonell, D. A. Gilmour, and D. F. Sinclair.
Journal of Hydrology, Vol. 42, No. 3/4, p 251-267, July 1979. 7 fig, 3 tab, 20 ref.

Descriptors: *Runoff, *Watersheds(Basins), *Tropical regions, *Australia, *Model studies, Mathematical models, Rainfall, Overland flow, Discharge(Water), Streamflow, Statistics, Statistical methods, Storms, Storm runoff, Rain forests, Mathematics, Hydrographs, Hydrology, Tropical rainforests.

This paper presented a statistical method for translating the lag response between overland flow, stream discharge, and rainfall in a tropical rainforest of northeastern Australia in terms of the disposition of the rainfall on the catchment. The experimental plot was about 0.016 ha in area and was a component of a 26-ha experimental catchment that had characteristic slopes of about 30%. A simple lagged regression model fitted the data well. The results indicated lag responses of 6-12 min between rainfall and overland flow and 12-24 min between rainfall and stream discharge. An explanation of these short and variable lag responses was sought in the discussion of the hydrological processes involved. (Sims-ISWS)
W80-00748

A FINITE-ELEMENT DISTRIBUTED CATCHMENT MODEL, II. APPLICATION TO REAL CATCHMENTS,
King's Coll., London (England). Dept. of Civil Engineering.
A. W. Jayawardena, and J. K. White.
Journal of Hydrology, Vol. 42, No. 3/4, p 231-249, July 1979. 7 fig, 3 tab, 14 ref.

Descriptors: *Runoff, *Watersheds(Basins), *Drainage, *Model studies, Mathematical models, Finite element analysis, Rainfall, Precipitation(Atmospheric), Storms, Storm runoff, Hydrographs, Rivers, Streams, Streamflow, Hydrology.

The analytical basis for a distributed catchment model within the framework of the finite-element method was described in Part I of this paper. In Part II, the authors described a geometrical framework upon which the mathematical model was operated. This flexible framework was based upon the assumption that flow is normal to the topographical contours of the catchment. Thus, the catchment is subdivided into strips which run from the top of slopes to main drainage paths in directions normal to the contours. These, in turn, are then discretized into elements which form the basic components of the finite-element analysis. The proposed discretization and the algorithm were used to simulate several storm hydrographs using data collected from two experimental catchments. The problems, limitations, probable sources of error, and potential applications of the approach were discussed. (See also W77-12798) (Sims-ISWS)
W80-00749

FLOODS OF DECEMBER 1978 IN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
J. N. Sullavan, F. Quinones, and R. F. Flint.
Geological Survey open-file report 79-977, April 1979. 53 p, 15 fig, 6 tab, 4 ref.

Descriptors: *Floods, *Kentucky, *Flood data, *Flood damage, Streamflow, Peak discharge, Sediment transport, Water quality, Storms, Precipitation(Atmospheric), Flood frequency, Data collections.

In 1978, severe flooding throughout the State of Kentucky occurred from December 3-10 as a result of intense precipitation from two storms. The storms of December 3-5 and December 7-10 produced record peak discharges in several areas throughout central and eastern Kentucky, resulting in damages of nearly 50 million dollars and the loss of five lives. This report summarizes data collected during the floods by the U.S. Geological Survey, Water Resources Division, and other Federal and State agencies in Kentucky. The data include precipitation, streamflow, and water-quality data (including suspended sediment). Estimates of property damages in selected basins are also provided. The information is preliminary and subject to revisions. (Woodard-USGS)
W80-00758

FLOOD PROFILES ALONG THE CEDAR RIVER, KING COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
O. C. Hettick.
Geological Survey Water-Resources Investigations 78-84 (open-file report), 1979. 23 p, 3 fig, 3 tab.

Descriptors: *Flood profiles, *Flood frequency, *Peak discharge, *Flood forecasting, *Regulated flow, Reservoirs, Evaluation, *Cedar River(Wash), King County(Wash).

Flood profiles on the Cedar River, King County, Wash., were developed from 21.1 to 33.65 miles upstream from the mouth for the flood of December 3-4, 1975, and for a 100-year flood. Estimated water-surface elevations during a 100-year flood indicate virtually all the flow would be contained in the river channel. Since 1914, Cedar River flows have been affected by impoundment and release of storage from Chester Morse Lake at river mile 35.6, and since 1901 by diversion for water supply at river mile 21.6. Flood-frequency analysis, based on 62 years of regulated flows (period 1915-76), indicate the 100-year flood would have a discharge of 8,600 cubic feet per second at river mile 23.4 and 6,870 cubic feet per second at river mile 33.2. The highest flood since regulation began occurred December 3 and 4, 1975, and was 7,930 cubic feet per second at river mile 23.4 and 6,860 cubic feet per second at river mile 33.2. Recurrence interval of this flood is about 70 years at river mile 23.4 and about 100 years at mile 33.2 under present conditions of storage and regulation. (Woodard-USGS)
W80-00760

TECHNIQUE FOR ESTIMATING THE MAGNITUDE AND FREQUENCY OF FLOODS IN ST. LOUIS COUNTY, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
D. W. Spencer, and T. W. Alexander.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 245, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-139, November 1978. 23 p, 10 fig, 4 tab, 20 ref.

Descriptors: *Flood forecasting, *Peak discharge, *Regression analysis, *Urban hydrology, *Rural areas, Rainfall-runoff relationships, Frequency analysis, Streamflow, Flow rates, Design flood, Equations, Drainage areas, Permeability, Small watersheds, *St. Louis County(MO).

Equations and nomographs in this report can be used to estimate peak flood discharges having recurrence intervals up to 100 years in rural and urban areas of St. Louis County, MO. The basin characteristics significant at the 5-percent probability level were drainage area and percentage imperviousness. Drainage area can be measured from maps, while percentage of imperviousness can either be measured from aerial photographs or estimated from land-use projections. These equations are based upon the analysis of hydrologic data collected at 30 continuous-recording gaging stations with drainage areas ranging from 0.8 to 39.0 square miles, and with impervious areas ranging from 1 to 32 percent. (Woodard-USGS)
W80-00762

EFFECTS OF URBANIZATION ON THE MAGNITUDE AND FREQUENCY OF FLOODS IN NORTHEASTERN ILLINOIS,
Geological Survey, Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 4C.
W80-00769

STATISTICAL SUMMARIES OF ARIZONA STREAMFLOW DATA,
Geological Survey, Tucson, AZ. Water Resources Div.
T. W. Anderson, and N. D. White.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 354, Price codes: A18 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-5, January 1979. 416 p, 1 fig, 2 tab, 1 ref.

Descriptors: *Streamflow, *Flow rates, *Gaging stations, *Arizona, *Hydrologic data, Peak discharge, Flood frequency, Flow duration, Low flow, High flow, Average flow, Statistical methods.

Statistical summaries of streamflow data are presented for 143 gaging stations in Arizona. The summaries are given for all active streamflow-gaging stations at which flow is unregulated, for discontinued stations that have at least 5 years of record, and for a few stations at which the flow is partly regulated. Included in the summaries are (1) log-Pearson type III flood-frequency data for selected streamflow-gaging stations, (2) annual peak discharges and gage heights and annual volumes, (3) duration tables of daily discharges, (4) lowest mean discharges, (5) highest mean discharges, (6) statistics on normal monthly mean discharges, and (7) statistics on normal annual mean discharges. (Woodard-USGS)
W80-00771

2F. Groundwater

GROUND-WATER MANAGEMENT TECHNIQUES FOR THE CONTROL OF SALT-WATER ENCROACHMENT IN GULF-COAST AQUIFERS, A SUMMARY REPORT,
Geological Survey of Alabama, Montgomery.
G. R. Walter, R. E. Kidd, and G. M. Lamb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102965, Price codes: A05 in paper copy, A01 in microfiche. Report, 1979, 84 p, 10 fig, 4 tab. OWRT B-073-ALA(1).

Descriptors: *Saline water encroachment, *Groundwater management, Numerical models, Aquifers, Gulf Coast.

The fresh ground-water resources of the Gulf Shores area of Alabama occur in four principal aquifers. In order of increasing depth, these are designated the Beach Sand aquifer, the Gulf Shores aquifer, the 350-Foot aquifer, and the 500-Foot aquifer. The 350-Foot aquifer and the 500-Foot aquifer contain fresh water at the coastline and may contain fresh water for some distance beneath the Gulf of Mexico. Only in the Beach Sand aquifer can the cases of salt-water contamination be unequivocably attributed to seawater encroachment. Based on the results of numerical modeling and interpretation of the water chemistry, the cases of contamination in the Gulf Shores aquifer may be due to leakage of saline water around well bores, leakage from confining beds and movement of pockets of relic salt water within the aquifer rather than lateral seawater encroachment.
W80-00490

SOURCES, TRANSPORTATION AND UTILIZATION OF DISSOLVED ORGANIC MATTER IN GROUNDWATER AND STREAMS,
Department of Fisheries and Environment, Burlington (Ontario).
P. M. Wallis.
Kananaskis Centre for Environmental Research, Calgary University, Alberta, Canada. Inland Waters Directorate, Water Quality Branch, Ottawa, Canada, 1979. Scientific Series No. 100, 1979. 49 p, 20 tab, 34 fig, 85 ref.

Descriptors: *Marmot Basin(Ontario), *Dissolved solids, *Surface-groundwater relationship, *Groundwater movement, *Dissolved organic matter, Groundwater runoff, Soil water movement, Subsurface flow, Saturated flow, Unsaturated flow, Laurel Creek(Ontario), Subsurface waters, Hydrology, Streams.

This report describes primarily the hydrology of the Marmot Basin, located approximately 80 km west of Calgary, Alberta, Canada, and the transportation of dissolved organic matter (DOM). Experiments were also undertaken at a site near Leamington, Ontario, in Laurel Creek near Waterloo, and in the laboratory. DOM enters the stream from groundwater, throughfall and precipitation, and from the leaching of particulate organic matter. In the Marmot Basin almost all groundwater is discharged by the streams draining the catchment area because of the presence of bedrock of low permeability. Rainfall dripping through vegetation contains significantly more DOM than does precipitation sampled in the open. In the Marmot Basin maximum stability of DOM is found in streams and maximum variation is found in groundwater. Most of the DOM resulting from litter fall is consumed terrestrially and only a small amount of highly refractory material is exported by the streams. The estimated transport rate of groundwater in the Marmot Basin in the unsaturated zone is 0.017 m/day and in the saturated zone it is 0.14 m/day; it takes groundwater about 10 years on the average to reach the stream. (Iervolino-NC)
W80-00530

CASING AND LEAK DEPTHS, AND SOLUTE TRAVEL TIMES TO WELLS,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W80-00579

GROUND WATER REPLENISHMENT FROM RIVERFLOW,
Lincoln Coll. (New Zealand). Dept. of Agricultural Engineering.
B. D. van't Woudt, J. Whittaker, and K. Nicolle.
Water Resources Bulletin, Vol. 15, No. 4, p 1016-1027, August 1979. 9 fig, 3 ref.

Descriptors: *Groundwater recharge, *Induced infiltration, *River flow, Underflow, Groundwater movement, River beds, Wells, Permeability, Aquifers, Seepage, Water levels, Water table, Maps, Measurement, Hydraulic gradient, New Zealand, Piezometric surface maps.

Groundwater contours and gradients were determined within and adjacent to a gravelly riverbed with about 100 m active channel width and about 800 m floodplain width during low flow, making use of about 60 shallow dug wells and one deeper cased well. Groundwater slopes away from the riverbed to the south and slopes to the riverbed from the north. Replenishment of groundwater to the south is past a 'shell,' a zone of low permeability at the margin of and below the riverbed, (1) into a shallow aquifer from 'sideway-spill-over,' and (2) into an underlying aquifer that is seemingly confined by the 'shell.' Seepage from river channels to underflow takes place all along channel lengths except below riffles where the flow direction is reversed. Half the seepage to underflow is lost to groundwater replenishment. Underflow seems to constitute merely a few percent of total riverflow but makes a disproportionate contribution to groundwater replenishment. (Visocky-ISWS)
W80-00604

ON THE GROWTH OF INSTABILITIES IN GROUNDWATER DUE TO TEMPERATURE AND SALINITY GRADIENTS,
Technion--Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
H. Rubin, and C. Roth.
Advances in Water Resources, Vol 2, No 2, p 69-76, June 1979. 6 fig, 12 ref.

Descriptors: *Groundwater movement, *Thermocline, *Salinity, Buoyancy, Aquifers, Flow, Heat transfer, Heat flow, Thermal water, Temperature, Convection, Diffusion, Hydraulic gradients, Boundary processes, Hydrodynamics, Numerical analysis, *Thermohaline convection, *Instabilities, *Gradients.

A combination of temperature and salinity distribution in an aquifer may induce various types of hydrodynamic instabilities. It was assumed that the aquifer can be represented by an idealized model of a saturated porous layer, bounded on top and bottom by impermeable boundaries at which the temperature and salinity are constant. In stable and unperturbed conditions, the fluid flows through this layer uniformly in the horizontal direction owing to the hydraulic gradient. By linear stability analysis, it was found that three different mechanisms may lead to instability of the flow field: (1) buoyancy forces may induce convection currents (thermohaline convection), (2) the difference between the rate of heat and salinity diffusion may induce oscillations (overstable motions), and (3) the difference between the velocity of propagation of heat and of salinity fronts may induce oscillations. The effect of mechanism (3) varies according to the type of aquifer. An aquifer in which the fluid is initially at rest is not affected at all by mechanism (3). In an aquifer of limited length, subject to hydraulic flow, mechanism (3) limits the growth of instabilities to planes perpendicular to the hydraulic gradient. In an aquifer of unlimited length mechanism (3) may completely neutralize the stabilizing effect of the salinity gradient and lead to thermohaline convection in planes parallel to the hydraulic gradient. Calculations of heat transfer through various types of aquifer by applying numerical simulations were presented. (Visocky-ISWS)
W80-00605

FOUNDATION THEORIES OF SOLUTE TRANSPORT IN POROUS MEDIA: A CRITICAL REVIEW,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2A.
W80-00606

MODELING GROUNDWATER FLOW FIELDS CONTAINING POINT SINGULARITIES: A TECHNIQUE FOR SINGULARITY REMOVAL,

Stanford Univ., CA. Dept. of Civil Engineering.
R. J. Charbeneau, and R. L. Street.
Water Resources Research, Vol. 15, No. 3, p 583-594, June 1979. 8 fig, 20 ref, 2 append. EPA-R-804431.

Descriptors: *Finite element analysis, *Numerical analysis, *Porous media, *Anisotropy, *Hydrodynamics, Groundwater, Wells, Leakage, Analysis, Heterogeneity, Galerkin technique, Green's functions.

Artificial recharge of groundwater resources through wells leads to a need for computer simulation of the hydraulics and transport of contaminants in a flow field. The basic numerical technique used is the Galerkin finite element method. Greatly improved accuracy of the simulation near wells is achieved first by removing the singular behavior of the flow with an analytic solution for the near-well zone, second by solving the remaining nonsingular problem, and third by combining the results. The resulting solutions compare favorably with known analytic solutions for confined and leaky aquifers (both isotropic and anisotropic). No additional computation time is required for this method compared to standard finite element methods programs. The resulting combined velocity fields are accurate enough throughout the flow field for direct use in contaminant transport simulations. (Adams-ISWS)
W80-00609

EFFECTS OF IN-TRANSIT WATER ON GROUNDWATER MOUNDS BENEATH CIRCULAR AND RECTANGULAR RECHARGE AREAS,
Colorado State Univ., Fort Collins. Engineering Research Center.
N. V. Ortiz, D. W. Zachmann, D. B. McWhorter, and D. K. Sunada.
Water Resources Research, Vol. 15, No. 3, p 577-582, June 1979. 4 fig, 14 ref.

Descriptors: *Groundwater movement, *Groundwater recharge, *Storage, *Recharge ponds, Analytical techniques, Unsteady flow, Infiltration, Unsaturated flow, Porous media.

Analytical solutions, accounting for the reduction in storage capacity caused by in-transit water, were presented for the growth of groundwater mounds in an unconfined aquifer in response to uniform deep percolation from a rectangular and circular recharging area. The solution for the circular case was obtained by integrating the solution for the analogous case of heat flow in a composite cylindrical region with respect to time. In the rectangular case, the solution was obtained by a product of two functions representing the solution for the instantaneous addition of a recharge slug over a long strip and integrating with respect to time. The aquifer is homogeneous, isotropic, infinite in areal extent, and resting on a horizontal impermeable base. Dimensionless curves were presented to afford a relatively simple means for the analysis of the growth of groundwater mounds. (Adams-ISWS)
W80-00610

NATURAL CONTROL OF THE CHEMICAL COMPOSITION OF WATER DURING THE INFILTRATION PROCESS--FIRST RESULTS (ACQUISITION DE LA COMPOSITION CHIMIQUE DE L'EAU AU COURS DE L'INFILTRATION EN MILIEU NATUREL--PREMIERS RESULTATS D'UNE ETUDE EXPERIMENTALE),
Bureau de Recherches Geologiques et Minieres, Orleans (France).
For primary bibliographic entry see Field 5B.
W80-00719

COMPUTATION OF THE ADVANCEMENT OF GROUNDWATER POLLUTION DUE TO PETROLEUM PRODUCTS ORIGINATING FROM A KNOWN SOURCE OF CONTAMINATION (LE CALCUL DE LA PROPAGATION DE LA POLLUTION DES EAUX SOUTERRAINES PAR DES MATERIAUX HUILEUX, PROVENANTS D'UNE SOURCE DE LA POLLUTION CONNUE),
Vyzkumny Ustav Vodohospodarsky, Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 5B.
W80-00720

THE APPLICATION OF A DIGITAL MODEL FOR EVALUATING THE BEDROCK WATER RESOURCES OF THE MAUMEE RIVER BASIN, NORTHWESTERN OHIO,
California Univ., Livermore. Lawrence Livermore Lab.
T. G. Naymik.
Ground Water, Vol. 17, No. 5, p 438-445, September-October 1979. 13 fig, 13 ref. DOE W-7405-Eng-48.

Descriptors: *Groundwater, *Water levels, *Withdrawal, *Ohio, *Indiana, *Model studies, Mathematical models, Computer models, Geology, Hydrology, Aquifers, Drawdown, Pumping, Water resources, Water supply, *Maumee River Basin(OH).

Increasing population and industrial development in northwestern Ohio indicated the need for an evaluation of the bedrock groundwater resources of the region. A digital groundwater model was designed and used as a tool for predicting water level declines resulting from projected groundwater withdrawal. Potentiometric surfaces, keyed to historic, accelerated, and peak projected groundwater withdrawals, were predicted by decades to the year 2036. These withdrawals at the calculated rates will cause severe overdrafts at Lima, Toledo, and Findlay, Ohio, and at Ft. Wayne, Indiana, by the year 2036. (Sims-ISWS)
W80-00726

A METHOD OF AQUIFER TESTING AND ITS APPLICATION TO AN ANISOTROPIC INHOMOGENEOUS MULTIPLE AQUIFER SYSTEM,
Geological Survey of Australia, Melbourne. Dept. of Minerals and Energy.
M. Riha.
Ground Water, Vol. 17, No. 5, p 423-428, September-October 1979. 7 fig, 14 ref.

Descriptors: *Aquifer testing, *Aquifers, *Aquifer systems, *Australia, Testing, Groundwater, Wells, Drilling, Groundwater movement, Transmissivity, Isotropy, Hydraulic properties, Pollutants, Path of pollutants, Water pollution, *Melbourne(Australia), Aquifer testing methods.

A new method of testing anisotropic, inhomogeneous multiple aquifer systems makes use of small diameter bore construction techniques and enables simultaneous testing of superposed aquifers and aquitards (aquicludes). Because of the low cost of the method, the hydraulic properties of the multiple aquifer system can be determined at many sites distributed throughout the area of interest, enabling simulation of the local and regional groundwater flow conditions and other hydrological characteristics of the system. Since its development in 1964, the technique improved and was employed in groundwater investigations. Data and results from the inhomogeneous, anisotropic multiple aquifer system west of Melbourne were given. (Sims-ISWS)
W80-00727

EVAPORATION FROM VEGETATION IN LANDSCAPES DEVELOPING SECONDARY SALINITY USING THE VENTILATED-CHAMBER TECHNIQUE, I. COMPARATIVE TRANSPIRATION FROM JUVENILE EUCALYPTUS ABOVE SALINE GROUNDWATER SEEPS,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2I.
W80-00755

DIGITAL MODEL OF THE HOLLISTER VALLEY GROUND-WATER BASIN, SAN BENITO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-00756

GROUND-WATER APPRAISAL FOR THE COMMUNITY OF KIRYAS JOEL, ORANGE COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2A.
W80-00759

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1978,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 4D.
W80-00764

2G. Water In Soils

SOURCES, TRANSPORTATION AND UTILIZATION OF DISSOLVED ORGANIC MATTER IN GROUNDWATER AND STREAMS,
Department of Fisheries and Environment, Burlington (Ontario).
For primary bibliographic entry see Field 2F.
W80-00530

SOIL WATER IN COARSE FRAGMENTS,
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
C. T. Hanson, and R. L. Blevins.
Soil Science Society of America Journal, Vol. 43, No. 4, p 819-820, July-August 1979. 1 tab, 4 ref.

Descriptors: *Soil water, *Sandstones, *Shales, Available water, Field capacity, Wilting point, Soils, Soil types, Rocks, Soil-water-plant relationships, Soil science, Stony soils, Coarse fragments.

The amount of availability of water contained in coarse fragments is often considered to be negligible, but availability of water may in fact play an important role in the water relations of soils containing numerous coarse fragments. The objective of this study was to measure the availability of water contained in two contrasting types and several size fractions of fragments. Field capacity, -15 bar potential, and wilting point (WP) measured by plant extractions were made on sandstone fragments from the surface layers of Cutshin soil and shale fragments from a Colyer soil. The sandstone fragments contained about 11% available water by volume, and the shaly fragments contained 23% available water by volume based on WP measurements by plant removal in the greenhouse. The -15 bar potential determined in the laboratory compared closely with WP measured by plant removal for the sandstone fragments, but the -15 bar potential indicated higher levels of moisture retained in the shale fragments than WP as determined in the greenhouse. (Sims-ISWS)
W80-00592

INFLUENCE OF SURFACE ROUGHNESS AND CLOD SIZE AND STABILITY ON SOIL AND WATER LOSSES,
Science and Education Administration, Lafayette, IN.
For primary bibliographic entry see Field 2J.
W80-00593

ABSORPTION OF WATER BY SOIL: THE CONSTANT FLUX BOUNDARY CONDITION,
Commonwealth Scientific and Industrial Research Organization, Canberra City (Australia). Div. of Environmental Mechanics.
I. White, D. E. Smiles, and K. M. Perroux.
Soil Science Society of America Journal, Vol. 43, No. 4, p 659-664, July-August 1979. 8 fig, 1 tab, 18 ref.

Descriptors: *Soil water, *Absorption, *Diffusion, *Mathematical models, Model studies, Soils, Infil-

tration, Steady flow, Moisture content, Wetting, Soil science, Flux-concentration relations.

Absorption of water into soil as the result of a constant flux condition at the soil surface was examined. Experiments for a fine sand showed that the surface water content, movement of the wetting front, and the water content profiles may be predicted from the soil water diffusivity function using the notion of the flux-concentration relation of Philip. Reduced space and time variables X = (V sub o)x and T = (V sub o) sq t were introduced. Use of these variables greatly simplifies treatment of the system and reveals that the surface water content and the reduced position of the wetting front are uniquely defined by T, while the water content profiles at any value of T are unique in terms of X. (See also W74-02464) (Sims-ISWS) W80-00596

NATURE AND PROPERTIES OF WATER IN MONTMORILLONITE-WATER SYSTEMS,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
P. F. Low.
Soil Science Society of America Journal, Vol. 43, No. 4, p 651-658, July-August 1979. 7 fig, 1 tab, 30 ref.

Descriptors: *Groundwater, *Montmorillonite, *Water properties, *Model studies, Mathematical models, Chemicals, Water chemistry, Clays, Lithium, Sodium, Thermal capacity, Hydrogen bonding, Viscosity, Thermodynamics.

Data were presented on several properties of water in montmorillonite-water systems. The data indicated that these properties differ from the same properties of bulk water because of differences in intermolecular bonding. Also, it was found that the value, J, of each property is described by the general equation J = J(o) exp beta/(m sub w/m sub m) in which J(o) is the value of the given property in pure bulk water, m sub w/m sub m is the mass ratio of water to montmorillonite, and beta is a constant. The proposal was made that, since all of the water properties obey a common equation, their deviation from the corresponding properties of bulk water must be caused by a common factor. By making appropriate substitutions for m sub w/m sub m and analyzing the resulting equations, the common factor was shown to be interaction of the water with the surfaces of the montmorillonite layers. The nature of this interaction, and ways in which it might affect intermolecular bonding, were discussed. (Sims-ISWS) W80-00597

RELATIONS BETWEEN GEOMETRICAL PROPERTIES OF GLASS BEADS MEDIA AND THEIR MAIN PSI(THETA) HYSTERESIS LOOPS,
Tunis Univ. (Tunisia). Dept. of Hydraulics.
Ch. Laroussi, and L. W. De Backer.
Soil Science Society of America Journal, Vol. 43, No. 4, p 646-650, July-August 1979. 7 fig, 1 tab, 20 ref.

Descriptors: *Hysteresis, *Porous media, *Pores, Laboratory tests, Data processing, Wetting, Drying, Drainage, Moisture content, Soil science, Glass beads, Pore size.

A main hysteresis loop in the volumetric water content (theta)-suction (psi) relation was determined experimentally for each of seven narrow size fractions of glass beads. Geometrical properties of these media were separately obtained with a Purcell apparatus based on mercury intrusion. A linear relation between the mean radius of beads and the mean radius of pores was established. A computational model was established to relate the main hysteresis loops of porous media to their geometrical properties. As a consequence a diagram expressed in nondimensional variables psi* and theta* was proposed to predict the main hysteresis loop of a similar porous medium whose geometrical properties are deduced by similitude from one of the explored fractions. (Sims-ISWS) W80-00598

A MODIFIED PERMEAMETER FOR MEASURING HYDRAULIC CONDUCTIVITY OF SOILS,
Gezira Agricultural Research Station, Wad Medani (Sudan).
A. E. Fadl.
Soil Science, Vol. 128, No. 2, p 126-128, August 1979. 3 fig, 1 tab, 3 ref.

Descriptors: *Hydraulic conductivity, *Soil properties, *Permeameters, *Laboratory tests, Physical properties, Soil physical properties, Permeability, Equipment, Instrumentation, Soils, Soil water, Soil water movement, Soil science.

A modified apparatus that permits measurement of hydraulic conductivity of undisturbed soil cores in the laboratory was described. In this technique, the two traditional errors, i.e., side flow and destruction of soil structure, were simultaneously controlled. The results obtained were significantly lower and more realistic than those of the traditional technique. (Sims-ISWS) W80-00614

USE OF FLUORESCENT DYES TO MARK THE PATHWAYS OF SOLUTE MOVEMENT THROUGH SOILS UNDER LEACHING CONDITIONS: 2. FIELD EXPERIMENTS,
Reading Univ. (England). Dept. of Soil Science.
U. Omoti, and A. Wild.
Soil Science, Vol. 128, No. 2, p 98-104, August 1979. 9 fig, 9 ref.

Descriptors: *Solutes, *Soil water, *Soil water movement, On-site investigations, Dyes, Fluorescent dye, Photography, Ultraviolet radiation, Irrigation, Rainfall, Chlorides, Soils, Soil science, Pyranine, Fluorescein.

Fluorescein and pyranine were used as solute markers in field experiments under irrigation and under winter rainfall. Dye distribution was recorded by ultraviolet photography and was also measured from analyses of soil extracts. Ultraviolet photographs showed uneven horizontal distribution of fluorescein. The main causes were (1) earthworm channels, which appeared to be more important for solute transport under irrigation than under winter rainfall; (2) fissures about 0.05 to 0.10 millimeters wide; and (3) loosely packed soil with varied pore sizes. Although the dye was adsorbed by soil, the vertical distribution followed a similar pattern to that of chloride, suggesting that it was conducted down the same channels as more mobile solutes. (Sims-ISWS) W80-00615

PHYSICAL CONDITION OF A DAVIDSON CLAY LOAM AFTER FIVE YEARS OF HEAVY POULTRY MANURE APPLICATIONS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
R. R. Weil, and W. Kroontje.
Journal of Environmental Quality, Vol 8, No 3, p 387-392, July-September 1979. 5 fig, 4 tab, 24 ref.

Descriptors: *Soil physical properties, *Farm wastes, *Poultry, Soil moisture, Infiltration, Aggregates, Bulk density, Soil structure, Soils, Soil properties, Invertebrates, Soil water, Soil water movement, Hydraulic conductivity, Soil science, Poultry manure.

Little information is available on how soil physical properties are affected by very heavy poultry manure applications often associated with concentrated poultry production. In this study, after 5 years of applying up to 110 metric tons of poultry manure/ha per year to corn plots, the physical condition of the manured plots differed markedly from that of the unmanured controls. During the spring, the activity of soil invertebrates created a highly channelized and aggregated structure in the surface soil. Plowlayer bulk density was reduced by the poultry manure from 1.1 to 0.8 g/cu cm, and the percentage water-stable aggregates increased from 73 to nearly 94%. About half of the variability in bulk density could be accounted for by differences in soil organic matter contents. The manured plots were generally more moist in the plow layer, especially in spring and early summer when a perched water table at a depth of 20 cm was caused by a water-repellent plowsole layer of partially decomposed manure. In the spring, this layer resulted in infiltration rates on the manured plots as low as 0.02 cm/hour compared to a mean of 12.1 cm/hour on the controls. In November, the infiltration rate of the manured plots rose to 57 cm/hour due to the activities of earthworms. The manured plots held nearly 42% moisture at 0.1 bar tension as compared to 32% for the control plots. Incorporation of poultry manure by means other than moldboard plowing might avoid the creation of a plowsole manure layer which counteracts the potentially beneficial effects of the manure on soil structure and water-holding capacity. (Sims-ISWS) W80-00620

NATURAL CONTROL OF THE CHEMICAL COMPOSITION OF WATER DURING THE INFILTRATION PROCESS--FIRST RESULTS (ACQUISITION DE LA COMPOSITION CHIMIQUE DE L'EAU AU COURS DE L'INFILTRATION EN MILIEU NATUREL--PREMIERS RESULTATS D'UNE ETUDE EXPERIMENTALE),
Bureau de Recherches Geologiques et Minieres, Orleans (France).
For primary bibliographic entry see Field 5B.
W80-00719

COMPUTATION OF THE ADVANCEMENT OF GROUNDWATER POLLUTION DUE TO PETROLEUM PRODUCTS ORIGINATING FROM A KNOWN SOURCE OF CONTAMINATION (LE CALCUL DE LA PROPAGATION DE LA POLLUTION DES EAUX SOUTERRAINES PAR DES MATERIAUX HUILEUX, PROVENANTS D'UNE SOURCE DE LA POLLUTION CONNUE),
Vyzkumny Ustav Vodohospodarsky, Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 5B.
W80-00720

SIMULATION MODEL OF THE EVOLUTION OF THE CHEMICAL COMPOSITION OF A MINERAL-SOLUTION SYSTEM AND ITS APPLICATIONS (MODELE DE SIMULATION DE L'EVOLUTION DE LA COMPOSITION CHIMIQUE D'UN SYSTEME MINERAUX-SOLUTION ET SES APPLICATIONS),
Groupement d'Etudes et de Realisations des Societes d'Amenagement Regional, Nimes (France).
For primary bibliographic entry see Field 5A.
W80-00721

PREDICTING HYSTERETIC EFFECTS IN EVAPORATION FROM BARE SOIL,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
For primary bibliographic entry see Field 2D.
W80-00732

BEST WAYS TO DEWATER DREDGED MATERIAL,
Oklahoma State Univ., Stillwater. Dept. of Geotechnical Engineering.
T. A. Haliburton.
Civil Engineering--American Society of Civil Engineers, Vol. 49, No. 8, p 57-61, August 1979. 7 fig, 1 tab.

Descriptors: *Vacuum drying, *Dewatering, *Dredging, Sediment transport, Evaporation, Spoil banks, Trenches, Disposal, Soil moisture, *Dredged material, *Dewatered dredged material, Spoil, Trenching, Diked disposal area, Surface trenching, Trenching equipment, Vacuum well points.

Left to its own devices, fine-grained dredged material placed in confined disposal areas reaches an equilibrium water content near its Atterberg liquid limit. The high water content of such dredged material effectively prohibits its use in any productive manner, and storage of the liquid fraction reduces available volume for future dredged material disposal. Various literature and laboratory

studies, followed by field experiments, were conducted to develop technically feasible, operationally practical, and cost-effective methods for removing excess water from confined dredged material and reture it to normal soil consistency. Progressive trenching, to remove ponded surface water from the site and to enhance evaporative drying, and various types of underdrainage dewatering were found to satisfy the selection criteria. Dewatering by vacuum well points, crust mixing and agitation, and electro-osmosis was not satisfactory. (Roberts-ISWS)
W80-00733

MEASUREMENT OF APPARENT ELECTRICAL CONDUCTIVITY OF SOILS BY AN ELECTROMAGNETIC INDUCTION PROBE TO AID SALINITY SURVEYS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
E. de Jong, A. K. Ballantyne, D. R. Cameron, and D. W. L. Read.
Soil Science Society of America Journal, Vol. 43, No. 4, p 810-812, July-August 1979. 2 fig, 1 tab, 5 ref.

Descriptors: *Soils, *Electrical conductance, *Salinity, Instrumentation, Equipment, On-site investigations, Surveys, Electromagnetic waves, Electronic equipment, Evaluation, Soil properties, Irrigation, Salts, Soil science, Soil electrical conductivity, Salinity measurement, Soil salinity, Electromagnetic induction probes, Salinity surveys.

A noncontacting soil resistivity probe, based on electromagnetic induction, was used to measure soil salinity. Good correlations were obtained between the apparent bulk soil conductivity measured by the instrument and the electrical conductivity of saturated paste extracts or the bulk electrical conductivity measured by the Wenner four-probe method. The electromagnetic induction technique provided less detailed information on salinity changes with depth than the other methods, but was faster and can provide a continuous record of salinity changes along a transect. (Sims-ISWS)
W80-00750

INEXPENSIVE FOUR-ELECTRODE PROBE FOR MONITORING SOIL SALINITY,
Science and Education Administration, Riverside, CA. Salinity Lab.
J. D. Rhoades.
Soil Science Society of America Journal, Vol. 43, No. 4, p 817-818, July-August 1979. 3 fig, 10 ref.

Descriptors: *Soils, *Salinity, *Electrical conductance, Equipment, Electronic equipment, Surveys, Monitoring, Irrigation, Infiltration, Soil water, Salts, Soil properties, Soil science, Soil electrical conductivity, Earth resistivity, Four-probe salinity probes, Salinity measurement.

Description was given of the construction and use of an inexpensive four-electrode probe suitable for permanent installations and for in situ monitoring of soil salinity. Data illustrative of its use were presented. (Sims-ISWS)
W80-00751

A COMPACT, LOW-COST CIRCUIT FOR READING FOUR-ELECTRODE SALINITY SENSORS,
Science and Education Administration, Riverside, CA. Salinity Lab.
R. S. Austin, and J. D. Rhoades.
Soil Science Society of America Journal, Vol. 43, No. 4, p 808-810, July-August 1979. 3 fig, 2 ref.

Descriptors: *Soils, *Electrical conductance, *Salinity, Instrumentation, Equipment, Electronic equipment, Surveys, Soil properties, Salts, Irrigation, Electronics, Electrical engineering, Soil science, Soil electronical conductivity, Salinity measurement, Soil salinity, Four-probe salinity sensors.

An electrical circuit was described that uses a minimal number of components to measure soil electrical conductivity using the four-electrode salinity sensor. The portable circuit is compact, inexpensive, reliable, and easy to construct. (Sims-ISWS)
W80-00752

A GALERKIN IN TIME, LINEARIZED FINITE ELEMENT MODEL OF 2-DIMENSIONAL UNSATURATED POROUS MEDIA DRAINAGE,
Iowa State Univ., Ames. Dept. of Agronomy.
J. H. Cushman, D. Kirkham, and R. F. Keller.
Journal of the Soil Science Society of America, Vol. 43, No. 4, p 638-641, July-August 1979. 8 fig, 7 ref. NSF ENG 75-19394.

Descriptors: *Drainage, *Soils, *Mathematical models, *Finite element analysis, Unsteady flow, Unsaturated flow, Time, Seepage, Porous media, Equations, *Two-dimensional flow, *Galerkin method, Soil columns.

Two-dimensional drainage in porous media by a modified finite element technique was examined. This technique consists of using Galerkin's method on the temporal as well as the spatial dimensions and coupling it with a simple linearizing scheme (considering physical properties constant over individual elements). This method was applied to four separate drainage problems, two of which have been studied previously. Results compared well with both of the previous studied problems. (Visocky-ISWS)
W80-00753

PHYSICAL COMPONENTS OF THE DIFFUSIVITY COEFFICIENT,
Louvain Univ. (Belgium). Dept. of Genie Rural.
R. S. Malik, C. Laroussi, and L. W. De Backer.
Journal of the Soil Science Society of America, Vol. 43, No. 4, p 633-637, July-August 1979. 7 fig, 2 tab, 15 ref.

Descriptors: *Diffusivity, *Viscosity, *Pores, *Porous media, Aqueous solutions, Surface tension, Capillary action, Wetting, Moisture content, Model studies, Laboratory tests, Pore size, Glass beads, Heat of vaporization.

Isothermal horizontal infiltration experiments were conducted in 53-63 micrometer, 74-88 micrometer, or 105-125 micrometer glass bead fractions with water, 6% ethyl alcohol water solution, 20% ethyl alcohol water solution, ethyl alcohol, and methyl alcohol. From these experiments, the diffusivity coefficient was determined, and D (theta) was established for the fluid content, theta, from 0% to saturation. The D (theta) variation in the fluid content range between 3 and 30% was investigated. The functional relationships between D (theta) and the properties of the fluid, the geometry and the solid matrix were investigated. The physical components of D (theta) were determined using: D (theta) = ((r* sq/R* sq) x (sigma(cos alpha)/mu) - 0.00041 Delta H + 5) x 0.01 theta where r* and R* are the mean radius of pores and beads, respectively, sigma, micron, and Delta H sub v are the surface tension, viscosity and molar heat of vaporization of the fluid, respectively, and alpha is the fluid-solid contact angle. The physical significance of the diffusivity coefficient given by Laroussi and De Backer (1975) defining this coefficient as the ease with which the fluid particles spread from a wetting front, is clarified and confirmed. (See also W76-01851) (Visocky-ISWS)
W80-00754

2H. Lakes

PHYSIOLOGICAL ADAPTATIONS OF SALMONID FISHES (SALMO CLARKI HENSHAWI, SALMO GAIRDNERI, AND ONCORHYNCHUS KISUTCH) TO ALKALINE SALINE WATER AND THEIR TOXIC EFFECTS,
Nevada Univ. System, Reno. Desert Research Inst.
J. Knoll, D. L. Koch, R. Knoll, J. Sommer, and L. Hoffman.
Desert Research Institute Publication No. 50009, July 1979, 82 p, 15 fig, 10 tab, 60 ref. OWRT B-087-NEV(1), 14-31-0001-5136.

Descriptors: *Fish physiology, Adaptation, Alkaline water, Salmo clarki, Salmo gairdneri, Oncorhynchus kisutch, Trout.

Two studies were conducted to determine the physiological adaptations of 3 salmonid fishes to the alkaline, slightly saline waters of Pyramid Lake, NV, and their toxic effects. In the acclimation study, growth rates and blood parameters of fingerling Lahontan cutthroat trout and Eagle Lake rainbow trout were compared when maintained in alkaline well water (pH 9.1), in Pyramid Lake water (pH 9.1), and in a 50% mixture of these waters. In the 2nd study a more detailed analysis was made of the morphological changes in the blood cells and other hematological parameters in rainbow trout that had been exposed to Pyramid Lake water. Results of the acclimation study indicate that Lahontan cutthroat trout in the 0.5 to 6 g size range were considerably more successful when raised in the Pyramid Lake water than in either the mixed or well water. The morphology of the blood cells of coho salmon, Lahontan cutthroat trout and well water exposed rainbow trout was similar. The leucocyte morphology of rainbow trout exposed to Pyramid Lake water exhibited atypical forms after 7 days exposure with these forms persisting throughout the study. Leucocyte counts were significantly lower after 7 days in Pyramid Lake water exposed rainbow trout than in well water exposed fish. In differential leucocyte counts of the Pyramid Lake water exposed rainbows, lymphocytes significantly decreased and neutrophils significantly increased throughout the study. These atypical forms, decreased leucocyte counts and increased neutrophil percentages may indicate a sublethal stress condition. (Smith-Nevada)
W80-00488

COOLING IMPOUNDMENTS: CLASSIFICATION AND ANALYSIS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
G. H. Jirka, and D. R. F. Harleman.
Journal of the Energy Division, American Society of Civil Engineers, Vol. 105, No. EY2, Proceedings Paper 14779, p 291-309, August 1979. 8 fig, 3 tab, 17 ref, 1 append.

Descriptors: *Cooling water, *Impoundments, *Classification, *Analysis, Model studies, Mathematical models, Ponds, Lakes, Powerplants, Heat transfer, Stratification, Thermal stratification, Temperature, Flow, Circulation, Water circulation.

Cooling impoundments can have different degrees of internal temperature stratification and of internal flow circulations. Classification criteria were presented that predict the existence of these internal conditions based on the size and shape of the impoundment, the condenser flowrate, temperature rise, and the design of intake and discharge structures. A computer model for the prediction of transient temperature distributions in cooling impoundments was developed. Depending upon the hydrothermal condition, one of four model elements was applied: (1) natural reservoir model for computation of lightly loaded ponds or of natural baseline conditions; (2) a deep stratified cooling pond model for well stratified impoundments; (3) a shallow dispersive cooling pond model for well channelized, elongated pond shapes; and (4) a shallow recirculating cooling pond model for ponds with significant internal circulation patterns. Comparison with applicable field data showed good agreement with the predictive models. (Sims-ISWS)
W80-00580

WEAK AND STRONG ACIDS IN THE SURFACE WATERS OF THE TOVDAL REGION IN S. NORWAY,
Central Electricity Generating Board, Leatherhead (England). Research Lab.
For primary bibliographic entry see Field 2K.
W80-00624

SEASONAL CHANGES IN THE SPECTRAL COMPOSITION OF DOWNWELLING IRRADIANCE IN LAKE KINNERET (ISRAEL),

Bar-Ilan Univ., Ramat Gan (Israel). Dept. of Life Sciences.
Z. Dubinsky, and T. Berman.
Limnology and Oceanography, Vol. 24, No. 4, p 652-663, July 1979. 15 fig, 3 tab, 42 ref.

Descriptors: *Irradiation, *Lakes, *Seasonal, Solar radiation, Light, Light penetration, Euphotic zone, Chlorophyll, Zooplankton, Light quality, Wavelengths, Optical properties, Biology, Limnology, *Israel, *Lake Kinneret(Israel), Downwelling irradiance.

A submersible scanning radiometer was used to measure seasonal variations in the intensity and spectral characteristics of downwelling irradiance in Lake Kinneret, Israel. Extinction coefficients for photosynthetically active radiation (350-750 nm) varied from 0.2 to 3.3 ln units/m, and the euphotic zone (1% of light energy at surface) ranged from 1.7 to 11 m. Specific extinction coefficients of chlorophyll, k sub c (ln units/mg/sq m), and water, k sub w (ln units/m), were dependent on the wavelength at which they were measured (at 650 nm, k sub c = 0.011, k sub w = 0.693; for 350 to 750 nm, k sub c = 0.007, k sub w = 0.489). High concentrations of chlorophyll and other cell pigments during the annual Peridinium bloom strongly attenuated light penetrance and caused a spectral shift toward the red to give elevated quantum to joule (Q:W) ratios (2.96 x 10 to the 18th power). (Sims-ISWS)
W80-00629

IMPORTANCE OF LAKE-RIVER INTERACTION ON SEASONAL PATTERNS IN THE GENERAL CIRCULATION OF KAMLOOPS LAKE, BRITISH COLUMBIA,
Department of the Environment, Vancouver (British Columbia). Inland Water Directorate.
E. C. Carmack, C. B. J. Gray, C. H. Pharo, and R. J. Daley.
Limnology and Oceanography, Vol. 24, No. 4, p 634-644, July 1979. 11 fig, 21 ref.

Descriptors: *Lakes, *Canada, *Water circulation, *Rivers, Mixing, Temperature, Water temperature, Density, Turbidity, Circulation, Flow, Seasonal, On-site investigations, Heat budget, Limnology, *Thompson River(British Columbia), *British Columbia, *Kamloops Lake(British Columbia), Cabbeling.

The physical effects of a large river (Thompson River) entering a deep, intermontane lake (Kamloops Lake, British Columbia) suggest that, depending upon its temperature relative to that of lake water, river water moves through the lake as a surface overflow, an intermediate depth interflow, or a near-bottom underflow. Circulation is further influenced by the earth's rotation so that the incoming river flows preferentially along the right-hand shoreline of the lake. Convective overturn in autumn and spring is influenced by cabbeling, which occurs whenever two parcels of water, one warmer than 4 C and one colder, combine to form a mixture whose temperature is at or near 4 C. (Sims-ISWS)
W80-00631

NEW ASPECTS OF THE CONSIDERATION OF FEEDBACK MECHANISMS IN AN ECOLOGICAL MODEL OF THE PELAGIC ZONE,
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
J. Benndorf, D. Uhlmann, and F. Recknagel.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 170-184, 1978. 11 fig, 44 ref.

Descriptors: *Ecosystems, *Lakes, *Aquatic life, *Model studies, Productivity, Growth rates, Freshwater, Mixing, Phytoplankton, Biomass, Attenuation, Nutrients, Phosphates, Pelagic zone, Feedback mechanisms.

In order to achieve a more realistic model of the pelagic zone of lakes and reservoirs, three feedback mechanisms were investigated. (1) A 'mixing model' involves higher light utilization by the phytoplankton at intensive vertical mixing of the water body, a high light attenuation coefficient, and a low mixing depth. This combination of variables results in higher primary production rates compared with the conventional (static) model. As the high light attenuation coefficient is self-generated by the high phytoplankton biomass, this phenomenon can be taken as a positive feedback mechanism. (2) In connection with the vertical mixing in water with mass growths of phytoplankton, a further positive feedback loop plays an essential role: the self-regenerated carbon dioxide flux within the algal-bacterial association. (3) The negative feedback between the biomass and specific activity (e.g., rate of phytosynthesis per unit biomass) leads to a more sophisticated version of the Monod kinetics and enables the model to respond realistically to external disturbances. (See also W79-00379) (Humphreys-ISWS)
W80-00715

NUTRIENT EXCHANGE BETWEEN VOLUME ELEMENTS OF LARGE LAKES,
Canada Centre for Inland Waters, Burlington (Ontario).
T. J. Simons, and D. C. L. Lam.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 185-191, 1978. 4 fig, 7 ref.

Descriptors: *Water quality, *Lakes, *Model studies, *Great Lakes, *Lake Ontario, On-site investigations, Nutrients, Mathematical models, Analytical techniques, Ecosystems, Distribution, Movement, Mass transfer, Heat balance, Stratification, Phosphorus, Nitrogen, Carbon, Chlorophyll, Water circulation, Spatial distribution.

In recent years it has become possible to incorporate a complete description of three-dimensional mass exchanges in water quality models of large lakes. The present paper reviewed some experiments with water quality models of Lake Ontario which include hydrodynamic simulations of horizontal and vertical water transports. The effects of mass exchanges were illustrated by combining observed concentration gradients with computed water motions. Considered were vertical exchanges across the thermocline and horizontal transports between shore zones and open water. It was shown that the resulting internal nutrient loadings are far greater than direct external inputs. (See also W79-00379) (Humphreys-ISWS)
W80-00716

WATER QUALITY IN LENTIC WATER BODIES (LAKES AND RESERVOIRS),
Salford Univ. (England). Dept. of Civil Engineering.
B. Henderson-Sellers.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 192-199, 1978. 6 fig, 22 ref.

Descriptors: *Water quality, *Lakes, *Model studies, *Lentic environment, Reservoirs, Water temperature, Analytical techniques, Mathematical models, Dissolved oxygen, Hypolimnion, Stratification, Heat transfer, Freshwater, Diffusivity, Destratification, Spatial distribution.

A one-dimensional numerical model for prediction of vertical variations in temperature and water quality in a freshwater lake or reservoir was described. Vertical transfer is by wind-induced turbulent diffusion: several forms for the coefficient of eddy diffusivity for both heat and oxygen were discussed. Water quality was analyzed in terms of the dissolved oxygen content, for which a knowledge of respirative sinks and photosynthetic sources is necessary. The average, annual structure of a lake was predicted utilizing the long-term stability of such systems, and comparisons were made with data from a number of British lakes and reservoirs. It was apparent that the hypolimnetic water is often unsuitable for human consumption during periods of stratification. Measures to eliminate the thermocline or to enhance the oxygen levels in the hypolimnion were discussed, and a numerical model of 'jetting' was described and implemented. (See also W79-00379) (Humphreys-ISWS)
W80-00717

MODELLING OF THE EUTROPHICATION PROCESS IN LAKES AND RESERVOIRS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
M. Watanabe.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 200-210, 1978. 4 fig, 2 tab, 13 ref.

Descriptors: *Lakes, *Eutrophication, *Model studies, *Aquatic environment, Mathematical studies, Analytical techniques, Nitrogen, Phosphorus, Ecosystems, Water properties, Zooplankton, Phytoplankton, Water temperature, Dissolved oxygen, Biochemical oxygen demand, Biodegradation, Oxidation, On-site tests

A closed, energy-driven, matter-flow loop of nitrogen-phosphorus cycles was proposed as a fundamental structure for understanding and controlling the eutrophication process in aquatic environments. It consists of 11 storage variables of nitrogen and phosphorus, and 14 transformations which represent observable biochemical reactions and ecological interaction. The mathematical model was applied to a microcosm experiment, and the comparison between predicted versus measured values supported the validity of the matter-flow rate mechanism of phosphorus and nitrogen cycles, although some modifications for modelling of phytoplankton and zooplankton are necessary. (See also W79-00379) (Humphreys-ISWS)
W80-00718

SOURCE SCHEMATIZATION EFFECTS ON FARFIELD RESULTS,
Envirosphere Co. Inc., New York
A. P. Verma, and S. R. Gutti.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY8, Technical Notes, p 1026-1031, August 1979. 2 fig, 1 tab, 7 ref, 1 append.

Descriptors: *Mathematical models, *Water temperature, *Jets, *Spatial distribution, Dispersion, Analytical techniques, Model studies, Equations, Convection, Diffusion, Distribution patterns, Heated water, Outlets, Mixing, *Thermal plumes, Farfield zone.

Most mathematical models determine the temperature distribution associated with cooling water discharge from power plants by treating the affected region of receiving water bodies as nearfield and farfield zones. The nearfield zone is the part of the thermal field closest to the actual outfall, predominantly influenced by the configuration, momentum, and buoyancy of the discharge. The farfield represents the zone some distance away from the discharge and is characterized by the passive convection and diffusion mechanisms due to ambient flow regime. The present work examined the sensitivity of the farfield model results to three postulated source schematizations for a typical power plant discharge case. The following conclusions were from the results presented. For increasing distances from the source, the influence of source schematization on temperature distribution diminishes, as expected. The top hat distribution with uniform temperature equal to the maximum temperature (Case 2) approximates the Gaussian distribution (Case 1) more closely than does Case 3 with regard to prediction of temperature distribution. From a strictly engineering analysis point of view, the range of variation in the predicted values is tolerable and is of the same order of magnitude for the different source schemes. However, when one examines these numerical results, from a point of view of complying with thermal regulations or biological impact evaluation, these differences may be significant. (Humphreys-ISWS)

W80-00723

COMPARISON OF SELECTED CULTURAL, PHYSICAL, AND WATER-QUALITY CHARACTERISTICS OF LAKES IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
G. C. Bortleson, and N. P. Dion.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 311, Price codes: A07 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 77-62, 1979. 54 p, 20 fig, 2 tab, 35 ref.

Descriptors: *Washington, *Lakes, *Limnology, *Chemical properties, *Physical properties, Lake basins, Water quality, Nutrients, Nitrification, Phosphorus, Dissolved oxygen, Eutrophication, Secchi disks, Measurement, Specific conductivity, Coliforms, Lake morphology, Lake morphometry.

The report presents comparisons and a graphical overview of the relative magnitude and regional and statewide distribution of 19 selected cultural, physical, and water-quality characteristics measured in a reconnaissance study of several hundred lakes in Washington. Statewide, mean depth of almost one-fourth of the lakes is shallow (2.0 meters or less), and only 7 percent of the lakes have mean depths greater than 20 meters. About one-third of the lakes had Secchi-disc readings of 2.0 meters or less, a value often considered characteristic of eutrophic lakes. The poorest water clarity was observed in the Columbia Plateau, where 68 percent of the lakes had Secchi-disc readings of less than 2.0 meters. More than one-third of the lakes in the State had total phosphorus concentrations that exceeded 30 micrograms per liter, a concentration that is often considered characteristic of eutrophic lakes. (Woodard-USGS)
W80-00766

2I. Water In Plants

RAINFALL INTERCEPTION BY EIGHT SMALL TREES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
A. R. Aston.
Journal of Hydrology, Vol. 42, No. 3/4, p 383-396, July 1979. 9 fig, 3 tab, 10 ref.

Descriptors: *Rainfall, *Interception, *Trees, Laboratory tests, Model studies, Mathematical models, Analytical techniques, Vegetation, Vegetation effects, Evaporation, Water storage, Leaves, Canopy, Rain, Throughfall.

Interception studies were undertaken on individual plants of selected tree species under a rainfall simulator. The results gave insight to the process of interception, provided information on the level of the interception storage of the test species, and illustrated the importance of leaf area. Two interception models were tested. The interception-drainage model gave unsatisfactory results. The modified exponential model proved adequate as long as the proportion of rainfall passing through the canopy could be estimated. This proportion was shown to be a function of leaf area index. The use of this model, together with a proposed simplified system, was discussed with the view of characterizing an ungaged plant community in which elaborate interception studies have not been undertaken. (Sims-ISWS)
W80-00744

EVAPORATION FROM VEGETATION IN LANDSCAPES DEVELOPING SECONDARY SALINITY USING THE VENTILATED-CHAMBER TECHNIQUE, I. COMPARATIVE TRANSPIRATION FROM JUVENILE EUCALYPTUS ABOVE SALINE GROUNDWATER SEEPS,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
E. A. N. Greenwood, and J. D. Beresford.
Journal of Hydrology, Vol. 42, No. 3/4, p 369-382, July 1979. 2 fig, 6 tab, 7 ref.

Descriptors: *Evapotranspiration, *Groundwater, *Water levels, *Trees, *Australia, On-site investigations, Transpiration, Evaporation, Measurement, Sampling, Salinity, Leaves, Forests, Agriculture, Vegetation effects, Biology, Eucalyptus trees.

Several Eucalyptus species were grown in plantations at three locations ranging in average annual rainfall from 420 to 850 mm. The main objective was to find for each site the species with the highest transpiration. At the latest sampling which was in summer about two years after germination, E. globulus showed the highest rate per tree (37 liter/day) immediately above a seepage area at the 850-mm site. At the 500-mm site, E. cladocalyx var. nana had the highest rate (30 liter/day), and at the 420-mm site, E. wandoo (26 liter/day) ranked first. Transpiration varied greatly among species. For those species common to all locations, transpiration declined with rainfall. Transpiration per unit leaf area also varied between species. At the 420-mm site, an increase in the average transpiration per unit leaf area, over all species, from 340 mg/sq cm/day in early summer to 1110 mg/sq cm/day in late summer suggested that the roots had reached a zone of higher water content. (Sims-ISWS)
W80-00755

2J. Erosion and Sedimentation

GEOMORPHIC STUDY OF UPPER MISSISSIPPI RIVER,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-00585

THE EFFECTS OF PH ON THE ALUMINUM, IRON AND CALCIUM PHOSPHATE FRACTIONS OF LAKE SEDIMENTS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
R. Nur, and M. H. Bates.
Water Research, Vol. 13, No. 8, p 813-815, 1979. 2 fig, 1 tab, 4 ref.

Descriptors: *Hydrogen ion concentration, *Effects, *Oklahoma, *Lake sediments, *Phosphates, Aluminum, Iron, Calcium, Phosphorus, Phosphorus compounds, Sediments, Chemistry, Chemical analysis, Nutrients, Sampling, Analytical techniques, Sedimentology, *Lake Carl Blackwell(OK).

A laboratory study was conducted to determine the effect of sediment pH on the amount of phosphorus bound in the aluminum, iron, calcium, and saloid-bound fractions of sediments from Lake Carl Blackwell, Oklahoma. The pH of the lake sediment samples was experimentally altered by mixing them with distilled water with pH values ranging from 1 to 12. Once the pH of the sediment and overlying water had equilibrated, a one gram sample was fractionated using a modified Chang and Jackson procedure to determine the phosphorus bound in each fraction. The point of minimum fixation for this sediment was found to occur at a pH of 7.33. Aluminum and iron phosphate fractions were predominant in an acidic environment. There was more phosphorus found in the aluminum and iron fractions than in the calcium fraction, and the amount of saloid bound phosphorus was minimal at every pH investigated. (Sims-ISWS)
W80-00588

INFLUENCE OF SURFACE ROUGHNESS AND CLOD SIZE AND STABILITY ON SOIL AND WATER LOSSES,
Science and Education Administration, Lafayette, IN.
C. B. Johnson, J. V. Mannering, and W. C. Moldenhauer.
Soil Science Society of America Journal, Vol. 43, No. 4, p 772-777, July-August 1979. 6 fig, 5 tab, 11 ref.

Descriptors: *Soil surfaces, *Erosion, *Runoff, *Water loss, Soils, Soil properties, Stability, Farm management, Infiltration, Simulated rainfall, Soil compaction, Soil moisture, Moisture content, Soil science, Agriculture, Surface roughness, Clod size, Tillage, Plowing.

Rough cloddy surfaces increased infiltration and decreased soil erosion compared to smoother surfaces as determined by simulated rainfall studies. Overtilling reduced surface roughness and cloddiness. One field experiment showed that a rough surface decreased runoff by 77% and soil erosion by 89% of that from a smooth surface. Tillage of wet soil increased surface roughness, but another field experiment showed that clods resulting from plowing the soil when wet were quite unstable compared with clods from plowing nearer the upper plastic limit. Tilling of compacted soil results in greater cloddiness than tilling of uncompacted soils. However, a laboratory experiment showed that compacted loam clods were less resistant to breakdown by water drop energy than those from uncompacted soil. Compaction of silty clay loam and silty clay soils did not change their stability significantly. To be effective as an erosion control measure, soil clods must be large enough and stable enough to keep infiltration at a high level until the crop canopy covers the soil surface. These studies described the size and stability necessary to maintain a high level of runoff and erosion control. (Sims-ISWS)
W80-00593

MICROBIAL EFFECTS ON SOIL ERODIBILITY,
Iowa State Univ., Ames. Dept. of Agronomy.
R. R. Gasperi-Mago, and F. R. Troeh.
Soil Science Society of America Journal, Vol. 43, No. 4, p 765-768, July-August 1979. 6 tab, 19 ref.

Descriptors: *Soil erosion, *Microorganisms, *Effects, Laboratory tests, Simulated rainfall, Bacteria, Soil bacteria, Fungi, Soil fungi, Actinomycetes, Soils, Soil types, Permeability, Soil aggregates, Soil microorganisms, Erosion, Soil science, Microbial effects.

This study was undertaken to evaluate the effects of three microbial species on soil erodibility. Sterilized Ames (a Typic Albaqualf) and Nicollet (an Aquic Hapludoll) soils were inoculated with species of Pseudomonas, Streptomyces, and Penicillium. After 15 days of incubation, both treated and untreated soils were subjected to artificial rainfall to measure their erodibility. The Ames soil averaged 23% more runoff and 34% more sediment in the runoff than Nicollet, but 2.25 times as much Nicollet soil as Ames soil was caught on splashboards. Soil loss from sterile soil was more than from any other treatment, and that from the fungal treatment was the least. The unsterilized soil had runoff and erosion approximately equal to the average of the bacterial, actinomycetes, and fungal treatments used. The results showed that all of the microbial treatments used had significant positive effects on erosion resistance and that the Penicillium sp. had the strongest effect. (Sims-ISWS)
W80-00594

AN ANALYSIS OF THE PROCESSES OF RIVER BANK EROSION,
Victoria Univ. of Manchester (England). Geography Div.
J. M. Hooke.
Journal of Hydrology, Vol. 42, No. 1/2, p 39-62, June 1979. 5 fig, 6 tab, 24 ref.

Descriptors: *Bank erosion, *Rivers, *Erosion, *Europe, Statistical models, Hydrology, Antecedent moisture content, Model studies, Precipitation(Atmospheric), *Devon(England), *Erosion processes, Antecedent precipitation index.

Measurements of erosion were made on sections of river banks in Devon, England, over a period of 2.5 yr. Erosion pins were used and were found to be satisfactory. Data of the hydrological and meteorological conditions during each erosion period were collected; these were incorporated into a

stepwise multiple regression analysis of the conditions controlling the amount and distribution of river bank erosion. Field observations were shown to aid considerably in understanding the processes of removal of material. Two main methods of bank erosion were identified, corrosion and slumping, and these appeared to be associated with the influence of river flow levels and antecedent precipitation conditions, respectively. Antecedent precipitation index emerged as the variable providing highest explanation of the erosion characteristics, but the diversity of results from different sites illustrated the complex combinations of conditions related to erosion events. A tentative grouping of the sites according to the types and amounts of erosion and the variables explaining their distribution was suggested. (Lee-ISWS)
W80-00612

AN ASSESSMENT OF THE EFFECTS OF BATHYMETRIC CHANGES ASSOCIATED WITH SAND AND GRAVEL MINING ON TIDAL CIRCULATION IN THE LOWER BAY OF NEW YORK HARBOR,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
Wong Kuo-Chuin, and R. E. Wilson.
Special Report No. 18, Reference 79-1, January 1979. 28 p, 9 fig, 2 tab, 6 ref.

Descriptors: *Mining, *Tidal currents, *Circulation, *Environmental effects, New York, Sands, Gravels, Bathymetry, New York Harbor, Sea Grant program.

Present sand and gravel mining operations within the Lower Bay of New York Harbor are restricted to the east bank of Ambrose Channel and to the vicinity of Chapel Hill North Channel because of the concern that mining in other areas might adversely affect water quality and shore erosion. As part of an evaluation of environmental effects associated with expanded sand and gravel mining were simulated numerically tidal circulation patterns and tidal elevations in Lower Bay for a number of altered bathymetries corresponding to hypothetical mining operations. Results suggest that tidal currents will decelerate over the mined region and accelerate outside of them, and that the tidal stream will be deflected towards the region. It is also clear that the mining near the mouth of the Bay could increase tidal range along Staten Island substantially. (NOAA)
W80-00693

THE LOWER BAY COMPLEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
I. W. Duedall, H. B. O'Connors, R. E. Wilson, and J. H. Parker.
MESA New York Bight Atlas Monograph 29. New York State Sea Grant Program report No. NYSSGP-AM-79-002, May 1979. 46 p, 18 fig, 4 tab, 60 ref, 10 maps. Oversized pages.

Descriptors: *Water pollution sources, *Tidal currents, Estuaries, New York, Nutrients, Water properties, New York Bight, New York Harbor, Sea Grant Program.

The Lower Bay complex is the seaward part of New York Harbor and includes Raritan, Sandy Hook, and Lower bays. It connects with Upper Bay through a narrow constriction between Staten Island and Brooklyn. A dynamic and complex estuarine system, the bay complex receives a large, seasonally variable inflow of fresh water originating mainly from the Hudson River with lesser amounts from the Raritan and Passaic rivers. Sewage effluent is also a significant source of fresh water. Because of the variable inflow of fresh water, the distribution of water properties (salinity, nutrients, chlorophyll (1) also varies seasonally. Tides and tidal currents in the bay complex are semidiurnal; their patterns are complicated because of the shape of the bay, the variation in freshwater discharge, Coriolis acceleration, and the intricate connection of waterways. Tidal variations in water properties are large and can be perturbed significantly by storms. Sewage effluent from the New York metropolitan area is the principal source for the high concentrations of nutrients observed in the bay complex. A large fraction of these nutrients are consumed in biological processes occurring within the bay complex. (NOAA)
W80-00695

TEXTURAL PROPERTIES OF SURFICIAL SEDIMENTS OF LOWER BAY OF NEW YORK HARBOR,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
C. R. Jones, C. T. Fray, and J. R. Schubel.
Special Report No. 21, Reference 79-4, March 1979. 118 p, 9 fig, 7 tab, 2 ref, 3 append.

Descriptors: *Sediments, *Sediment distribution, *New York, Sands, Gravels, Mining, Statistical data, New York Harbor, Textural properties, Grain size.

The objective is to describe the textural properties of the surficial sediments of the Lower Bay of New York Harbor. The grain size distributions are summarized in tabular form. Figures summarize the spatial distributions of selected statistical parameters: median diameter, mean diameter, standard deviation, skewness, and kurtosis. A figure delimits 25 areas in the Lower Bay of New York Harbor on the basis of sediment texture. The textural properties of samples within each of these 25 areas are summarized in tables. (NOAA)
W80-00696

SEDIMENT YIELD AND LAND USE IN TROPICAL CATCHMENTS,
Washington Univ., Seattle. Dept. of Geological Sciences.
T. Dunne.
Journal of Hydrology, Vol. 42, No. 3/4, p 281-300, July 1979. 6 fig, 2 tab, 52 ref.

Descriptors: *Sediment yield, *Watersheds(Basins), *Tropical regions, *Land use, On-site investigations, Model studies, Mathematical models, Sediment transport, Topography, Drainage, Geology, Vegetation, Soils, Roads, Runoff, Erosion, Sediment sources.

Analysis of sediment yields from 61 Kenyan catchments allowed the refinement of regional relationships between the yields and their major controls. Land use, which has been ignored in earlier regional analyses, was the dominant control, but within each land-use category it was possible to recognize the effects of the climatic and topographic variables that other writers have stressed. The long-term geologic rate of erosion in these tropical environments was estimated to vary between 20 and 200 t/sq km/yr, depending mainly upon climate. These values agree closely with Douglas' estimate for undisturbed catchments. An analysis of the major sources of sediment in disturbed catchments suggested that rural roads contribute a large, and commonly ignored, fraction of the sediment leaving agricultural areas. The temporal pattern of sediment transport is also affected by land use, and emphasizes the significance of rare wet periods in the removal of soil from tropical catchments. (Sims-ISWS)
W80-00746

2K. Chemical Processes

THE EFFECTS OF PH ON THE ALUMINUM, IRON AND CALCIUM PHOSPHATE FRACTIONS OF LAKE SEDIMENTS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
For primary bibliographic entry see Field 2J.
W80-00588

NATURE AND PROPERTIES OF WATER IN MONTMORILLONITE-WATER SYSTEMS,
Purdue Univ., Lafayette, IN. Dept. of Agronomy
For primary bibliographic entry see Field 2G.
W80-00597

DETAILED STRUCTURE OF PH IN HYDROMETEORS,
Maryland Univ., College Park.
D. E. Anderson, and H. E. Landsberg.
Environmental Science and Technology, Vol. 13, No. 8, p 992-994, August 1979. 2 fig, 4 tab, 17 ref. NSF ENV75-02 667-A03.

Descriptors: *Precipitation(Atmospheric), *Acidity, *Hydrogen ion concentration, *Maryland, Rain, Fog, Dew, Frost, Sampling, Chemical analysis, Trace elements, Sodium, Lead, Metals, Powerplants, Air pollution, Water pollution sources, On-site data collections, Analytical techniques, Vanadium, *Acid precipitation.

The pH values of various forms of atmospheric precipitation, dew, frost, fog were studied. Automatic precipitation collector-pH analyzers were developed for sampling of liquid and solid forms of precipitation. Data were collected under a wide variety of weather conditions at College Park, Maryland, near a major power plant, and from an area without nearby sources of pollution. Results from these three sites indicated that the precipitation pH, with a mean of 4.7, is not normally distributed when measured per millimeter of precipitation. In many events, a strong variation in pH was evident. In the course of the study, pH values ranged from 2.7 to 6.9 units. Sequential sampling upwind and downwind of a major power plant indicated that concentrations of nitrate, sulfur, trace metals (Na, Pb, V), and H(+) were higher downwind. Observations of dew and frost at three different sites indicated that the pH is normally distributed about 5.7 units. Values of fog water pH collected at Catoctin Mountain (near Camp David in northern Maryland) averaged 5.3 units. (Sims-ISWS)
W80-00616

WEAK AND STRONG ACIDS IN THE SURFACE WATERS OF THE TOVDAL REGION IN S. NORWAY,
Central Electricity Generating Board, Leatherhead (England). Research Lab
G. M. Glover, and A. H. Webb
Water Research, Vol 13, No 8, p 781-783, 1979. 2 fig, 9 ref

Descriptors: *Acids, *Rivers, *Lakes, Sampling, Chemical analysis, Hydrogen ion concentration, Acidity, Chemicals, Humic acids, Fulvic acids, Surface waters, Precipitation(Atmospheric), Snow, Snow melt, Water chemistry, *Norway, Weak acids, Strong acids.

The concentrations of weak and strong acids in surface waters of the Tovdal region of southern Norway were measured during a spring snowmelt period. The determinations were made by the pH titration method due to Gran. The strong acid concentrations in Tovdal river water varied between 3 and 11 microequivalents/liter, while the weak acid concentrations were between 62 and 106 microequivalents/liter. The contribution of the weak acids to the hydrogen ion concentration ranged between 10 and 60%. The pH of the river water varied from 4.9 to 5.0; and in the absence of excess strong acid, the weak acids would have produced a pH of 5.2-5.3. The concentration of weak acids and their contribution to the hydrogen ion concentration were least during the period of most rapid thaw. No direct evidence of the nature of the weak acids was obtained, but routine chemical analysis data suggested that inorganic species derived from aluminum and silicon accounted for 40-60 microequivalents/liter, while 20-50 microequivalents/liter were attributable to humic and fulvic acids. The titration characteristics of the weak acids could be approximated closely by a polybasic acid with a first ionization constant in the range 0.000001 to 5 x 10 to the -7 power and less well defined weaker ionizations. Measurements on old snow containing coniferous tree litter and on melt water from a rocky barren contained weak acid concentrations comparable to the riverwater, indicating that only slight contact with vegetable matter on the ground is required to obtain significant concentrations of weak acids. (Sims-ISWS)
W80-00624

CHEMICAL ASPECTS OF A BRINE POOL AT THE EAST FLOWER GARDEN BANK, NORTHWESTERN GULF OF MEXICO,
Texas A and M Univ., College Station. Dept. of Oceanography.
J. M. Brooks, T. J. Bright, B. B. Bernard, and C. R. Schwab.
Limnology and Oceanography, Vol. 24, No. 4, p 735-745, July 1979. 5 fig, 5 tab, 28 ref. BLM AA 550-CT7-15, AA550-CT7-11, ONR N00014-75-C-0537.

Descriptors: *Water chemistry, *Gulf of Mexico, *Brines, Sampling, Chemical analysis, Salts, Sulfur, Hydrogen sulfide, Chemicals, Sea water, Fish, Plankton, Oceans, Oceanography, *East flower garden bank.

A small pool on the flank of the East Flower Garden bank at a depth of 72 m in the Gulf of Mexico contains anoxic, hypersaline (approximately 200 g/kg) water. The flux of brine into and out of the pool contributes to erosional processes on the bank. The bulk ionic composition of the brine is similar to that of the Orca Basin brine, but differences between the two in gaseous hydrocarbon and carbon isotope content indicate different modes of origin. High levels of bacterial activity in the brine are indicated by ATP (more than 80 ng/liter), hydrogen sulfide (more than 2,000 micromol/liter), isotopically light Sigma CO2 (delta 13C = -23 parts per thousand), and the apparent generation of elemental sulfur. (Sims-ISWS)
W80-00626

IMPACT OF IRRIGATION WATER SALINITY ON SOIL RUNOFF WATER AND GROUNDWATER IN MISSOURI,
Science and Education Administration, Columbia, MO. North Central Watershed Research Center.
For primary bibliographic entry see Field 3C.
W80-00635

SIMULATION MODEL OF THE EVOLUTION OF THE CHEMICAL COMPOSITION OF A MINERAL-SOLUTION SYSTEM AND ITS APPLICATIONS (MODELE DE SIMULATION DE L'EVOLUTION DE LA COMPOSITION CHIMIQUE D'UN SYSTEME MINERAUX-SOLUTION ET SES APPLICATIONS),
Groupement d'Etudes et de Realisations des Societes d'Amenagement Regional, Nimes (France).
For primary bibliographic entry see Field 5A.
W80-00721

2L. Estuaries

TILLAMOOK BAY ENTRANCE REFRACTION STUDY, TILLAMOOK, OREGON,
Army Engineer Waterway Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W80-00501

WATER QUALITY INVESTIGATION OF ESTUARIES OF GEORGIA, 1976,
Brunswick Junior Coll., GA.
Annual report prepared for Georgia Department of Natural Resources, Environmental Protection Division, January 1977. 61 p, 38 ref, 27 tab, 5 fig.

Descriptors: *Water quality, *Fouling, *Estuaries, *Georgia, *Estuarine environment, *Chemical properties, *Physical properties, Aquatic environment, Aquatic algae, Water pollution, Savannah River(GA), St. Mary's River(GA), Fouling organisms.

Results are presented of the 1976 water quality analysis of Georgia's estuaries. Eleven stations were established along the coast of Georgia from the Savannah River to the St. Mary's River; data were collected from January to December 1976. The monitoring program included making determinations of several physical and chemical parameters in the field, collection of several water samples which were shipped to the Environmental Protection Division's water quality laboratory facilities, and collection, enumeration and identification of organisms attached to fouling plates. There was a positive correlation between the conductivity of the water and chloride concentration, total alkalinity and total solids. All stations were in oxidizing environments, were within the normal range of pH values and had low concentrations of nitrogen and phosphorous compounds. Dissolved oxygen was moderately high at all stations but was at its lowest concentration and saturation during the warm months May-September. Average biological oxygen demand (BOD5) was low at most stations. There was a direct relationship between number of organisms collected at a station and total organic carbon of the waters. Hydroids, barnacles, ectoprocts and tube building amphipods are the dominant fouling plate organisms and they showed very definite seasonal abundance patterns. (Iervolino-NC)
W80-00553

PERFORMANCE ANALYSIS OF TETHERED FLOAT BREAKWATER,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 8B.
W80-00587

SHELF SEA FRONTS' ADJUSTMENTS REVEALED BY SATELLITE IR IMAGERY,
University Coll. of North Wales, Menai Bridge. Marine Sciences Lab.
J. H. Simpson, and D. Bowers.
Nature, Vol. 280, No. 5724, p 648-651, August 23, 1979. 6 fig, 8 ref.

Descriptors: *Oceans, *Tides, *Ocean circulation, Remote sensing, Satellites(Artificial), Tidal waters, Circulation, Mixing, Infrared radiation, Temperature, Water temperature, Continental shelf, Oceanography, *Fronts(Oceanic), *Irish Sea.

IR imagery from NOAA 5 has been used to study the movement of shelf sea fronts. After the elimination of tidal advection, the fronts show remarkable consistency of position and do not adjust to the strong semi-monthly variation in tidal stirring which indicates the operation of a feedback process in vertical mixing. (Sims-ISWS)
W80-00603

ISOTOPIC COMPOSITION OF RIVER RUNOFF ON THE U.S. EAST COAST: EVALUATION OF STABLE ISOTOPE VERSUS SALINITY PLOTS FOR COASTAL WATER MASS IDENTIFICATION,
Woods Hole Oceanographic Institution, MA. Dept. of Chemistry.
T. Torgersen.
Journal of Geophysical Research, Vol. 84, No. C7, p 3773-3775, July 20, 1979. 1 fig, 2 tab, 13 ref. DOE E- 2185, NSF OCE76-81774.

Descriptors: *Isotope studies, *Rivers, *Atlantic Ocean, Runoff, Stable isotopes, Oxygen isotopes, Deuterium, Salinity, Sampling, Coasts, Oceans, Data processing, Oceanography.

Measurements of delta D and some delta 180 measurements were made on 36 rivers which drain the east coast of the United States. Streamflow data were used to estimate the mean isotopic composition of runoff entering the Gulf of Maine, the Mid-Atlantic Bight, and the South Atlantic Bight. Assuming binary mixing between central Atlantic water and these fresh runoff waters, coastal water in the Gulf of Maine was isotopically indistinguishable from runoff into the Mid-Atlantic Bight and runoff from the St. Lawrence at salinities greater than 32 parts per thousand. However, up to salinities of 34 parts per thousand the mean isotopic composition of runoff into the South Atlantic Bight was sufficiently different from the Mid-Atlantic Bight that the identification of coastal water masses in and around Cape Hatteras by delta D and/or delta 180 versus salinity plots should be possible. (Sims-ISWS)
W80-00607

ON THE GENERATION OF THE SEASONAL COASTAL UPWELLING IN THE GULF OF GUINEA,
Washington Univ., Seattle, Dept. of Oceanography.
A. J. Clarke.
Journal of Geophysical Research, Vol. 84, No. C7, p 3743-3751, July 20, 1979. 6 fig, 26 ref, 1 append. NSF IDO 7503998, DOE E76S062225TA25-7.

Descriptors: *Coasts, *Africa, *Atlantic Ocean, *Upwelling, *Model studies, Mathematical models, Internal waves, Waves(Water), Ocean waves, Measurement, On-site investigations, Water temperature, Water levels, Winds, Oceanography, *Gulf of Guinea.

Seasonal upwelling in the coastal waters of the Gulf of Guinea is unusual because classical coastal upwelling theory does not even qualitatively hold there; there is no significant relationship between the upwelling and the local longshore wind stress. In this paper an attempt was made to qualitatively explain the Gulf of Guinea seasonal upwelling using coastal trapped forced wave dynamics. Two independent sets of data were used to compare theory with observation. Both indicated that provided dissipation of the travelling wind-forced wave is taken into account, the theory agrees qualitatively with observation. The implication is that the upwelling is generated by coastal wind forcing several hundred kilometers east of the upwelling region. The Gulf of Guinea coastal upwelling therefore does not seem to be related to upwelling generated along the equator or to deep ocean basin forcing--it is not an 'anti El Nino', as has been postulated elsewhere. (Sims-ISWS)
W80-00608

CHEMICAL ASPECTS OF A BRINE POOL AT THE EAST FLOWER GARDEN BANK, NORTHWESTERN GULF OF MEXICO,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 2K.
W80-00626

DISTRIBUTION OF SUSPENDED BACTERIA IN NERITIC WATERS SOUTH OF LONG ISLAND DURING STRATIFIED CONDITIONS,
National Marine Fisheries Service, Beaufort, NC.
R. L. Ferguson, and A. V. Palumbo.
Limnology and Oceanography, Vol. 24, No. 4, p 697-705, July 1979. 6 fig, 3 tab, 32 ref. DOE AT(49-7)-5.

Descriptors: *Bacteria, *Marine bacteria, *Neritic, *Atlantic Ocean, Coasts, Continental shelf, Phytoplankton, Chlorophyll, Depth, Temperature, Water temperature, Sampling, On-site investigations, Data processing, Correlation analysis, Oceans, Biology, Marine biology, *New York Bight.

Bacteria (direct counts) averaged 1.85 million cells/ml in highly stratified waters south of Long Island during September 1976. The vertical distribution of bacteria was related to the location of the thermocline and the bottom, the horizontal distribution to distance from shore indicating longshore continuity. The average numbers of bacteria (million cells/ml) in neritic water were 2.14 nearshore, 1.96 midshelf, and 0.67 near the shelf break. Overall, the number of bacteria was positively correlated with chlorophyll and ammonium concentrations but not with measurements of heterotrophic activity. The location of a large, relatively inactive population of bacterial cells near the surface of the highly stratified midshelf water corresponded to the approximate location of unusually persistent phytoplankton blooms observed during March-June 1976. (Sims-ISWS)
W80-00627

THE PRODUCTION AND FATE OF PHYTOPLANKTON SIZE FRACTIONS IN THE PLUME OF THE HUDSON RIVER, NEW YORK BIGHT,
Lamont-Doherty Geological Observatory, Palisades, NY. Dept. of Marine Biology.

T. C. Malone, and M. B. Chervin.
Limnology and Oceanography, Vol. 24, No. 4, p 683-696, July 1979. 7 fig, 6 tab, 39 ref. NOAA 03-4-043-310, 04-5-022-22, 04-7-022-44003, DOE EY76-S-02-2185B.

Descriptors: *Phytoplankton, *Marine biology, *Estuaries, *Coasts, *Atlantic Ocean, Sampling, Data processing, Diatoms, Copepods, Biomass, Chlorophyll, Density, Water temperature, Salinity, Zooplankton, Nanoplankton, Carbon, Organic matter, Oceans, Oceanography, *New York Bight.

Seasonal effects fof water column stability phytoplankton growth, and copepod grazing on the biomass of phytoplankton size fractions were described in the context of variations in particulate organic carbon (POC). Net plankton biomass was more variable in time (between weeks and months), while nanoplankton biomass was more variable in space (between surface and bottom layers and between stations). Biomass was highest and most uniformly distributed during February-March when net plankton diatoms dominated and doubling times approximated the flushing time of the plume. Biomass declined rapidly with depth and distance from the mouth of the estuary during June-July when nanoplankton dominated and doubling times were short relative to the flushing time of the plume. Variations in POC were well correlated with phytoplankton biomass when net plankton dominated and biomass was limited by sinking and mixing. When nanoplankton dominated, biomass was limited mainly by grazing and correlations between POC and biomass were poor. It appears that most of the biomass produced by net plankton diatoms sinks from the surface layer before the summer thermocline develops, while most of the biomass produced by nanoplankton during the summer enters pelagic food chains before sinking from the surface layer. (Sims-ISWS)
W80-00628

ESTIMATES OF VERTICAL EDDY DIFFUSION THROUGH THE THERMOCLINE FROM PHYTOPLANKTON NITRATE UPTAKE RATES IN THE MIXED LAYER OF THE EASTERN TROPICAL PACIFIC,
Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.
F. D. King, and A. H. Devol.
Limnology and Oceanography, Vol. 24, No. 4, p 645-651, July 1979. 3 fig, 4 tab, 20 ref. ONR N00014-76-0271, NSF DES75-21280, NSF GB-7294.

Descriptors: *Diffusion, *Mixing, *Nitrates, *Pacific Ocean, Nutrients, Salinity, Density, Water temperature, Oxygen, Dissolved oxygen, Phytoplankton, Thermocline, Oceans, Oceanography, Marine biology, Eddy diffusion.

Vertical eddy diffusion coefficients ranging from 0.05-1.1 sq cm/s were calculated from phytoplankton nitrate uptake rates in the mixed layer and nitrate gradients at the top of the thermocline of the eastern tropical North Pacific. An empirical relationship was determined between these diffusion coefficients and density gradients in the thermocline. This relationship was used to calculate nitrate fluxes through the thermocline at several stations where nitrate uptake was not measured, and the fluxes indicated that an average of 29% of the primary productivity was supported by the uptake of nitrate-nitrogen. (Sims-ISWS)
W80-00630

UPWELLING AND ESTUARY FLUSHING,
Washington Univ., Seattle. Dept. of Oceanography.
A. C. Duxbury.
Limnology and Oceanography, Vol. 24, No. 4, p 627-633, July 1979. 3 fig, 3 tab, 3 ref.

Descriptors: *Estuaries, *Upwelling, *Water circulation, *Washington, On-site investigations, Measurement, Sampling, Flow, Mixing, Salinity, Pollutants, Saline water-freshwater interfaces, Harbors, Coasts, Estuary flushing.

Salinity data collected during 1965-1969 in Grays Harbor, Washington, along with river discharge data, were used to determine the water and salt budgets of the inner harbor. The fluxes of water at the seaward end of the inner harbor, T sub o seaward at the surface and T sub i inward at depth, were calculated. T sub o was proportional to but larger than the river discharge throughout the year except for the months of August through October when T sub o was related to T sub i and T sub i was driven by the influx of dense water into the harbor caused by upwelling along the coast. Thus, the flushing rate of the inner harbor, as determined by its volume divided by T sub o, is much greater during late summer than previously suspected. The calculated rate of removal of material associated with the water in the inner harbor, based on a T sub o derived from river flow and the percentages of river and harbor water making up T sub o, is 19% per day, in agreement with a previous flushing study. (Sims-ISWS)
W80-00632

THE LOWER BAY COMPLEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2J.
W80-00695

ON THE CHOICE OF BOUNDARY CONDITIONS FOR ONE-DIMENSIONAL MODELS OF ESTUARINE WATER QUALITY,
University Coll., Dublin (Ireland). Dept. of Civil Engineering.
J. P. O'Kane.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 77-85, 1978. 1 fig, 12 ref, 1 append.

Descriptors: *Water quality, *Estuaries, *Mathematical models, *Equations, Dispersion, Mathematical studies, Model studies, Convection, Diffusion, Spatial distribution, Theoretical analysis, Analytical techniques, Salinity, One-dimensional models, Mass balance.

The one-dimensional convective-diffusion equation was assumed to describe the dispersion of a contaminant in an estuary. Very general solutions were presented for Dirichlet (prescribed concentration) and zero Neumann (specified concentration gradient) boundary conditions. These correspond respectively to infinite and zero values of dispersion in the adjoining sea. The intermediate conditions were studied by matching at the mouth realistic dispersion models for both the sea and the estuary. This provides a basis for judging the validity of the Dirichlet condition which is almost always used. (See also W79-00379) (Humphreys-ISWS)
W80-00706

ADAPTATION OF THE EPAECO MODEL TO A LAKE IN CENTRAL FINLAND,
National Water Board of Finland, Helsinki.
K. A. I. Kinnunen, J. S. Niemi, and J. Eloranta.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 115-127, 1978. 8 fig, 1 tab, 12 ref.

Descriptors: *Model studies, *Lakes, *Ecosystems, *Water quality, Mathematical models, Aquatic environment, Discharge(Water), Phytoplankton, Biomass, Productivity, Dissolved oxygen, Water temperature, Alkalinity, Hydrogen ion concentration, Zooplankton, Dissolved solids, Phosphorus, Foreign research, *Finland, *Lake Paijanne(Finland), EPAECO model.

The one-dimensional, deterministic lake ecological simulation model EPAECO was applied to the uppermost sub-basin of Lake Paijanne, Central Finland. The model was calibrated with data from 1974 and verified with the corresponding data of 1975 and 1976. The agreement between simulated and observed values was evaluated simply by examining the graphical presentation of the results. Most of the state variables of the model could be verified, with the exception of phosphate phosphorus. Calculated values of the phytoplankton biomass were at the same level as the observed ones. Comparisons between simulated and observed values of some state variables, including zooplankton, detritus, benthic animals, total dissolved solids, and fish populations, could not be made because of insufficient observed data. It was concluded that more studies with different types of lakes should be carried out to obtain additional information on the suitability of the model as a management tool. (See also W79-00379) (Humphreys-ISWS)
W80-00710

A MATHEMATICAL ECOSYSTEM MODEL APPLICABLE TO SHALLOW WATER BODIES,
Deutsche Akademie der Wissenchaften zu Berlin (German D.R.). Inst. fuer Geographie and Geookologie.
G. Schellenberger, H-P. Kozerski, H. Behrendt, and S. Hoeg.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrlogical Sciences, Publication No. 125, p 128-136, 1978. 5 fig, 19 ref.

Descriptors: *Mathematical models, *Lakes, *Ecosystems, *Water quality, Model studies, Shallow water, Productivity, Detritus, Phytoplankton, Aquatic environment, Aquatic plants, Analytical techniques, Theoretical analysis, Phosphorus, Nitrogen, Algae.

In order to permit prediction and control of water quality, a general ecosystem model for shallow water basins was set up and tested against observed data from a chain of boddens (shallow inlets of the Baltic) and Lake Muggelsee. The model covers the energy flow through the system, the cycling of the nutrients phosphorus and nitrogen, and considers 17 components in an arbitrary number of horizontally arranged segments. Especial emphasis has been laid on the exchange of nutrients and particulate organic matter between sediment and water, on the significance of a resistant pool in the cycling of nutrients, and on a generalized formulation of all considered processes. The comparisons between observed data and computed simulations were relatively good. (See also W79-00379) (Humphreys-ISWS)
W80-00711

A SIMPLE EUTROPHICATION MODEL FOR THE BAY OF KESZTHELY, LAKE BALATON,
Research Inst. for Water Resources Development, Budapest (Hungary).
G. Jolankai, and A. Szollosi-Nagy.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 137-150, 1978. 5 fig, 16 ref.

Descriptors: *Mathematical models, *Lakes, *Eutrophication, *Water quality, Model studies, Analytical techniques, Theoretical analysis, Equations, Water chemistry, Hydrobiology, Hydrology, Phosphorus, Algae, Productivity, Biomass, Ecosystems, Algorithms, Foreign research, *Hungary, *Lake Balaton(Hungary).

Lake Balaton, and especially its Bay at Keszthely, is facing the danger of increasing eutrophication. Utilizing former plant nutrient discharge studies and records and also the records of lake hydrology, hydrobiology, and water chemistry, a simple algae-dissolved reactive phosphorus model was constructed to describe the eutrophication process. The model is mainly based on the specific condition that in Lake Balaton the main direct source of phosphorus is the uptake from the sediment with the indirect source being the input phosphorus load. The crucial point of modelling is the determination of the time varying (or rather varying as a function of meteorological factors) sediment phosphorus uptake coefficient. Consequently, a special parameter estimation technique was required. The dynamics of the model are nonlinear. On the other hand, the measurement equation is linear with a

white noise Gaussian measurement error sequence. To identify the unknown constants and the time varying parameters, the output error method was adopted. A recursive algorithm based on the maximum likelihood approach was developed for determining the unknown parameters and noise statistics. The algorithm utilizes the sensitivity matrix equation for the parameters. (See also W79-00379) (Humphreys-ISWS)
W80-00712

ENERGY EXCHANGE BETWEEN DEEP LAKES AND THE ATMOSPHERE AND THE CONSEQUENCES FOR THE WIND-MIXED LAYER DYNAMICS,
Haskoning, Nijmegen (Netherlands).
G. J. G. Kok.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 151-161, 1978. 4 fig, 8 tab, 17 ref.

Descriptors: *Lakes, *Boundary processes, *Mathematical models, *Water circulation, Air-water interfaces, Mixing, Ecosystems, Model studies, Deep water, Lake morphology, Heat transfer, Stratification, Interfaces, Energy transfer, Hypolimnion, Thermocline, Theoretical analysis, Equations, Analytical techniques, Wind velocity, Solar radiation, Epilimnion.

The exchange of heat and the input of wind energy through the water surface are essential mechanisms to explain the vertical distribution of turbulence and temperature in a deep lake with little throughflow. Depending upon the weather conditions and the lake's morphology, thermal stratification can appear, which separates the lake into a relatively warm turbulent surface layer, the epilimnion; and a relatively cold stagnant bottom layer, the hypolimnion. Both ecological sub-systems are divided by a movable interface, the thermocline. Following the wind-mixed layer theory from oceanography and applying the principle of heat conservation, the vertical distribution of temperature is computed as a function of time. Using daily mean weather data as forcing functions, the model is driven by the exchange of thermal and mechanical energies through the air-water and water-water interfaces. Anticipating pollution and eutrophication problems in deep lakes or reservoirs, modelling of the energy exchange at the water surface in relation to the wind-mixed layer dynamics gives a basic understanding of the physical limnology of the water body. (See also W79-00379) (Humphreys-ISWS)
W80-00713

HEAT AND MASS EXCHANGE COEFFICIENTS FOR OPEN WATER SURFACES,
Institute of Meteorology and Water Management, Warsaw (Poland).
For primary bibliographic entry see Field 2D.
W80-00714

SAND BED FRICTION FACTORS FOR OSCILLATORY FLOWS,
Coastal Engineering Research Center, Fort Belvoir, VA.
P. Vitale.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, WW3, Proceedings Paper 14754, p 229-245, August 1979. 8 fig, 1 tab, 17 ref.

Descriptors: *Beds, *Coastal engineering, *Energy dissipation, Ripple marks, Shear stress, Turbulence, Waves(Water), Hydraulics, Friction, *Bed forms, Coastal currents, Water tunnels, Wave attenuation, Oscillatory flows.

Published data from the Carstens, Neilsen, and Altinbilek oscillatory water tunnel tests were plotted as friction factor versus Reynolds number. These data, for three sand sizes and for both rippled and flat movable beds, were analyzed in a manner analogous to early treatment of flow in rough pipes that produced the Moody diagram. Laminar, transitional, and turbulent regimes were defined. The turbulent regime data were further analyzed to find the relative roughness, a combination of ripple height, grain size, and bottom particle displacement, which will predict the friction factor. The ripple heights for the 0.585 mm sand increased with increasing Reynolds number, while the ripple heights for the 0.297 mm and 0.190 mm sands decreased with increasing Reynolds number. Considering rippled beds only, the friction factor is proportional to the grain size divided by the square root of the Reynolds number. Grain roughness contributes 64% to 100% of the total bottom roughness, based on the relative roughness term. (Lee-ISWS)
W80-00734

ENERGETICS OF BREAKING WAVES WITHIN THE SURF ZONE,
Naval Postgraduate School, Monterey, CA. Dept. of Oceanography.
E. B. Thornton.
NR388-114.

Descriptors: *Waves(Water), *Ocean waves, *Coasts, *Beaches, Measurement, On-site investigations, Data processing, Turbulence, Energy, Velocity, Surf, Breaking waves.

Surface elevations and velocities were measured for a variety of breaking wave conditions including collapsing, plunging, and spilling breakers. Turbulent and wave-induced velocity components were separated by associating the wave-induced velocities with contribution coherent with the surface. Most of the measurements were made in the lower half of the water column and are indicative of conditions in this region. The average velocity intensity for all experiments was 85% wave induced, indicating that the kinetic energy is primarily wave induced. Remarkably little difference was found between collapsing, plunging, and spilling breakers in terms of percent wave-induced velocity intensity. Breaking waves can be characterized as highly nonlinear with strong wave-wave interactions resulting in energy being transferred away from the primary wave frequency, resulting in a saturation region at higher frequencies. Similarity arguments assuming kinematic instability with phase speed the only relevent parameter suggest a -3 slope for the log-log frequency spectrum of both the surface and horizontal velocities in shallow water. The surface elevation spectra of collapsing and plunging breakers have a slope more closely approximated by a -7/3 slope, indicating the possible importance of surface tension in the breaking processes; the velocity spectra show a -3 slope. The saturation region for spilling breakers surface elevation spectra varied from -3 at lower frequencies to -5 at highest frequencies. (Sims-ISWS)
W80-00737

SUMMERTIME SYNOPTIC VARIABILITY OF THE MIDDLE ATLANTIC SHELF WATER/SLOPE WATER FRONT,
Delaware Univ., Lewes. Marine Studies Complex.
C. N. K. Mooers, R. W. Garvine, and W. W. Martin.
Journal of Geophysical Research, Vol. 84, No. C8, p 4837-4854, August 20, 1979. 21 fig, 1 tab, 19 ref.
ONR N00014-76-C-1051.

Descriptors: *Oceans, *New Jersey, *Delaware, *Maryland, *Continental shelf, *Atlantic Ocean, Continental slope, Circulation, Ocean circulation, Ocean currents, Currents(Water), Temperature, Water temperature, Salinity, Density, Thermocline, Sampling, Surveys, Data collections, Data processing, Oceanography, *Fronts(Oceanic).

A quasi-synoptic study of the shelf water/slope water front off New Jersey, Delaware, and Maryland in mid-July 1977 revealed an isolated body of very cold (less than 6 C) water in the near-bottom 'cold pool'. Its volume at least halved over 10 days during which nearby shelf waters were perturbed by two anticyclonic (warm core) eddies located over the continental slope. Water colder than 6 C lay along the bottom between the 80- and 100-m isobaths and was about 30 m thick. The seaward edge of the cold pool (here denoted as colder than 8 C) marked the inshore boundary of the shelf water/slope water subsurface temperature front, with 10 C variations per 2-20 km, depending upon alongshelf location. The thermocline underwent large displacements and deformations over 10 days, indicative of vigorous upwelling and downwelling and large potential vorticity changes at the shelf break. The dominant scales of variability (or correlation scales) in the thermal fields were 30 km alongshelf, 10 km cross shelf, and 10 to perhaps 20 days. (The internal radius of deformation on the outer shelf is about 15-25 km). There was substantial vertical structure on the scale of 10 m or less. A surface convergence zone coincided with a surface roughness band ('tide rip') near the shelf break, and internal gravity wave activity seemed intense there too. Two independent estimates of vertical velocity at the shelf break suggested values of about 0.01 cm/s, one for a time scale of a week or longer and the other for a time scale of at least a few hours. Over Wilmington Canyon a large 'lip' of cold pool intruded into the slope water along the southwestern side of the Canyon, perhaps undergoing entrainment and 'calving' by an anticyclonic eddy located over the slope. There was further evidence of offshore entrainment throughout the water column between the two eddies. (Sims-ISWS)
W80-00740

LOW-FREQUENCY SEA LEVEL AND CURRENT FLUCTUATIONS ALONG THE COAST OF NORTHWEST ITALY,
SACLANT ASW Research Centre, La Spezia (Italy).
A. J. Elliott.
Journal of Geophysical Research, Vol. 84, No. C7, p 3752-3760, July 20, 1979. 12 fig, 1 tab, 16 ref.

Descriptors: *Sea level, *Currents(Water), *Coasts, *Europe, Wind tides, Oceanography, Ocean waves, Oceans, Foreign countries, Foreign research, *Sea level fluctuation, *Italy, Current fluctuation, Coastal current, Cyclogenesis.

Two-month long records of current, sea level, and wind stress, collected during April and May of 1977, were analyzed for locations in the shallow waters off the coast of northwest Italy. The mean current was directed along the coast towards the northwest with a strength of 5-6 cm/s; this flow continued past the island of Elba, progressing from the Tyrrhenian Sea into the Ligurian Sea. Sea level fluctuations were coherent along the Ligurian coast of Italy and were mainly due to a wind-induced setup caused by the semi-enclosed nature of the basin; only a fraction of the sea level disturbances in the Tyrrhenian Sea propagated into the Ligurian basin. There was low coherence between the nearshore current and sea level, suggesting that shelf waves may play only a minor role in the dynamics of the region. Instead, the relation among the wind stress, current, and the slope of the sea level suggested that the region displays characteristics similar to those of a semi-enclosed area. The alongshore currents were coherent with the wind at the 5-day time scale; this agrees with the period of cyclone activity in the area and suggests that the shelf waters respond coherently when the wind field is spatially well organized during cyclogenesis. Consequently, an adequate hydrodynamic model of the region would need to couple both the atmospheric and the coastal responses. (Lee-ISWS)
W80-00742

LABORATORY SIMULATION OF THE GYRE IN THE ALBORAN SEA,
Woods Hole Oceanographic Institution, MA.
J. A. Whitehead, Jr., and A. R. Miller.
Journal of Geophysical Research, Vol. 84, No. C7, p 3733-3742, July 1979. 14 fig, 17 ref.

Descriptors: *Simulation analysis, *Stratified flow, *Hydraulic models, Density stratification, Laboratory tests, Buoyancy, Coriolis force, Hydraulics, Model studies, Channels, *Gyre, *Alboran Sea, *Strait of Gibralter.

A laboratory experiment was described which appears to exhibit flows which are similar to the flow-counterflow in the Strait of Gibraltar and, for certain values of the parameters involved, to the

gyre and front in the western Alboran Sea. The experiment was transient in nature and was made with two connecting basins on a rotating turntable. A sliding door was fitted into the channel connecting the two basins. Each basin was filled with water, the door was closed, and salt added to one side so that the two waters had different densities. After the waters spun up to rest in the rotating frame, the door was opened. A flow, driven by the density imbalance, was observed shortly thereafter, the lighter fluid rising up over the heavier fluid and pushing into the basin containing the heavy fluid. Likewise, the heavy fluid pushes into the basin containing lighter fluid. For very rapid rotation, these flows are violently unstable. For less rapid counterclockwise rotation, both currents stay confined to a narrow jet which clings to the right-hand wall of the basins which they are entering. At some lower rate of rotation, the jet cannot hold to a sufficiently curved wall, and the jet separates from the wall--a gyre was observed between the jet and the wall. The gyre and the jet initially are both a Rossby radius in size, but gradually the gyre grows larger. Growth of the gyre seems to result from an accumulation of fluid from the jet as it returns to the wall. Scaling arguments and estimates of buoyancy, Coriolis, and wind forces were advanced in support of the concept that this laboratory-produced gyre and the gyre in the Alboran Sea share the same dynamics. (Lee-ISWS)
W80-00743

EVALUATION OF A DIGITAL MODEL FOR ESTUARINE WATER QUALITY SIMULATION IN WASTE ALLOCATION STUDIES,
Geological Survey, Tallahassee, FL. Water Resources Div
For primary bibliographic entry see Field 5B.
W80-00761

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

COST STRUCTURE IN DRINKING WATER SUPPLY AND THE PRICE STRUCTURES TO BE DERIVED FOR THEM,
Bochum (Germany, F.R.).
G. Schmidt.

Greatly increased water pollution and costs of uptake and purification in West Germany, coupled with drinking water demand which is doubling every 25-30 years, has shifted emphasis from variable costs dependent on output to fixed costs independent of output. Whereas in 1963 fixed costs accounted for 80% of total extraction costs, 81% of treatment costs, and 98% of distributioncosts, by 1974 these proportionshad risen to 88%, 84%, and 99%. Migration to suburbs has caused distribution problems and has also contributed to higher investment costs. Small-scale consumers and households have increased their share of total consumption from 55% in 1963 to 68% in 1975. A tariff system for water supply to such consumers should: (1) cover costs, (2) consider the enterprise's cost structure and the future movement of costs, (3) ensure adequate revenue, (4) help smooth load peaks for better capacity use, (5) limit wasteful water use, and (6) require only minimal enforecement costs regarding both monitoring and billing. According to an example given, the ratio of basic charge to unit price should approa40:60, customary in gas and electric supply. Basic charge should be figured on a variable basis determined by incurred. The problem of rising marginal costs on the input side can best be solved by periodically adjusting tstructure to the higher cost level rather than introducing complicated tariff systems dependent on assumed cons
W80-00485

3A. Saline Water Conversion

NON CONVENTIONAL WATER RESOURCES: SOME ADVANCES IN THEIR DEVELOPMENT,
Israel State Water Commission.
For primary bibliographic entry see Field 3C.
W80-00429

INCREASING AVAILABLE WATER SUPPLIES THROUGH WEATHER MODIFICATION AND DESALINATION,
Bureau of Reclamation, Washington, DC.
For primary bibliographic entry see Field 2B.
W80-00479

DEVELOPMENT OF A CHLORINE RESISTANT REVERSE OSMOSIS MEMBRANE AND POROUS MEMBRANE SUPPORTS,
Membrane Systems, Inc., San Diego, CA.
R. G. Sudak, M. E. McKee, R. L. Fox, and J. B. Bott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102973, Price codes: A05 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Research and Technology, May 1979. 88 p, 14 fig, 16 tab. OWRT S-0125(8510)(1), 14-34-0001-8510(1).

Descriptors: Membrane systems, *Reverse osmosis, Thin-film membranes, Asymmetric membranes, Chlorine resistance, Polyamides, Polyepichlorohydrin, Polysulfone, Polyphenylsulfone, Polycarbonate, Polyimide, Polyvinylidenfluoride, Polyphenylquinoxaline.

A major drawback in the use of polyamide membranes in reverse osmosis has been the susceptibility of the polyamide membrane to chlorine attack. It had been hypothesized that elimination of the secondary amines in the membrane barrier layer would provide chlorine resistance to polyamide type membranes. Accordingly, polyepichlorohydrin (secondary diamines) was synthesized and interfacially reacted with isophtaloyl chloride to form membrane layers. Although the secondary amine was eliminated, the expected chlorine resistance was not obtained. Limited data indicate that chlorine resistance was obtained with an asymmetric polyimide membrane. To date, composite membranes have almost exclusively used polysulfone as a porous support material. The following additional membrane supports were developed: polycarbonate, polyphenylsulfone, polyimide, polyvinylidenefluoride, and polyphenylquinoxaline. The development of these porous membrane supports is outlined. (Easton-OWRT)
W80-00487

3B. Water Yield Improvement

NON CONVENTIONAL WATER RESOURCES: SOME ADVANCES IN THEIR DEVELOPMENT,
Israel State Water Commission.
For primary bibliographic entry see Field 3C.
W80-00429

WATER RESOURCES DEVELOPMENT, AND MANAGEMENT PLANNING IN ARID ZONES: CASE HISTORY-ISRAEL,
Tahal Consulting Engineers (Israel).
For primary bibliographic entry see Field 6A.
W80-00457

3C. Use Of Water Of Impaired Quality

NON CONVENTIONAL WATER RESOURCES: SOME ADVANCES IN THEIR DEVELOPMENT,
Israel State Water Commission.
M. Kantor.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 3, p 1017-1040.

Descriptors: *Water resources development, *Water reuse, *Desalination, *Cloud setting, *Evaporation control, *Water supply development, Waste water reclamation, Water resources, Water demand, Israel, Waste water treatment, Distillation, Solar distillation, Reverse osmosis, Flash distillation, Electrodialysis.

Increasing water demand has led to utilization of unconventional sources of water, such as cloud seeding, evaporation suppression, phreatophyte removal, glacier tapping, desalination, wastewater reclamation, long-distance water hauling, and transport of icebergs. This paper evaluates progress in developing: (1) desalination, (2) waste-water renovation, (3) artificial rainfall stimulation (cloud seeding), and (4) evaporation reduction. At present, development of all four depends on techniques which are either not yet economically justifiable (desalination, sewage reclamation), or not yet feasible according to engineering criteria (cloud seeding, evaporation reduction). Six desalination processes are evaluated: (1) multistage flash distillation, (2) multi-effect distillation, (3) vapor compression, (4) reverse osmosis, (5) solar distillation, and (6) electrodialysis. Product water cost is approximately proportional to the optimal specific energy cost per unit water production. Choice of process depends on capacity and reliability required, salinity of feed water, skilled personnel available, fuel demand, and specific investment per unit capacity. Water reclamation and reuse is presently the most economical solution to water shortages and presents no insurmountable technical problems, but precautions are necessary to protect community well-being. Most cloud seeding experiments have not been in a controlled environment and evaluations have been inconclusive. Evaporation suppression, even with further improvements, is not likely to become economically justifiable. (Lynch-Wisconsin)
W80-00429

ON WATER REUSE PROMOTION MEASURES,
Ministry of International Trade and Industry, Tokyo (Japan).
For primary bibliographic entry see Field 6F.
W80-00477

MICROBIOLOGICAL WATER QUALITY IN RELATION TO PUBLIC HEALTH,
Department of Health, Pretoria (South Africa).
L. S. Smith, and G. I. Van Rooyen.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2547-2559.

Descriptors: *Microbiology, *Water reuse, *Water quality standards, *South Africa, *Public health, *Sewage treatment, Water purification, Water sources, Water supply development, Effluents, Advanced treatment, Tertiary treatment, Microorganism, Bacteria, Coliforms, E. coli, Recycling, Self-purification.

Wastewater reclamation is a practical solution to water scarcity under most conditions provided adequate precautions are taken to safeguard public health. Simple standards are necessary to measure the exposure risk to waters of different quality. This paper reports standards issued by the Department of Health of South Africa in 1967 (and later revised), along with a critique by experts and some results of microbiological studies. In South Africa about 32% of purified sewage effluent is reused, 16% for crops, and parks, 9% for cooling, and 7% for industry. It is noted that stringent standards should not be applied to situations requiring less-demanding standards. Bacteria in hospital effluents may be important in the spread of bacterial R+ factors. Antiviral chlorination can only be achieved in water virtually freed of organic matter; crude sewage effluent can be brought to the highest quality by advanced treatment; water can be assumed free of microbial disease if it conforms to a bacterial plate count of 100 ml, and has no coliforms of E. coli per 100 ml and no viruses per 10 liters. Self-purification in water bodies is not reliable for reducing pathogens to safe levels for direct use. Critics of the standards agreed that vegetables to be eaten raw should not be irrigated with effluents of lower grade than advanced purifi-

cation, but some doubted any vegetables should be irrigated with waters of coliform levels of 100 E. coli/100 ml. (Lynch-Wisconsin)
W80-00482

INTEGRATION OF THERMAL AND FOOD PROCESSING RESIDUALS INTO A SYSTEM FOR COMMERCIAL CULTURE OF FRESH-WATER SHRIMP. (POWER PLANT WASTE HEAT UTILIZATION IN AQUACULTURE)., VOLUME II,
Public Service Electric and Gas Co., Newark, NJ. Research and Development Dept.
A. F. Eble.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 185, Price codes: A08 in paper copy, A01 in microfiche. Final Report, January 1977. 161 p, 11 ref, 29 tab, 13 fig, 8 append. AEN 74140-79 AOL and GI-43925.

Descriptors: *Electric powerplants, *Aquiculture, *Shrimp, *Trout, *Heated water, Fish, Foods, Effluents, Food processing industry, Trenton(NJ), New Jersey, Fish farming, Electric power industry, Electric power, Eels.

American eel (Anguilla rostrata), rainbow trout (Salmo gairdneri), and all life-cycle stages of tropical freshwater prawns (Macrobrachium rosenbergii) can be cultured successfully using waste-heat effluents of the Mercer electric generating plant at Trenton, N.J. Experiments in indoor heated nurseries and outdoor ponds and raceways continued July 1974 to October 1976. Eels stocked at 25 cm and 40 g in early July double their weight in four months. High-density prawn cultures up to 16 animals sq m are possible in outdoor ponds and raceways plus draped netting. Larvae are grown indoors in December and six cm juveniles can be transferred outdoors in May and harvested as 11-12 cm adults in October. Outdoor prawns grow an average of 1.3 cm mo and 3.7 g mo. Six months of intensive, high-density prawn cultures utilizing power plant heated effluent in temperature climates yield the equivalent of 12 months extensive culture in the tropics. Rainbow trout growth averages 10-12 g wk (November-May) with most growth (17 g wk) in spring (April-May). Intensive annual two-crop production can be maintained: postlarval prawns are grown indoors in spring, placed in outdoor ponds in mid-May, and harvested in October. Eighteen cm rainbow trout are stocked in raceways in early November and harvested as young adults (28 cm, 260 g) in early May. Aquaculture pumps close during chlorine cleaning procedures for the generating station. (Danovich-Wisconsin)
W80-00497

IMPACT OF IRRIGATION WATER SALINITY ON SOIL RUNOFF WATER AND GROUNDWATER IN MISSOURI,
Science and Education Administration, Columbia, MO. North Central Watershed Research Center.
R. W. Blanchar, and C. J. Palmer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104839, Price codes: A07 in paper copy, A01 in microciche. Missouri Water Resources Research Center, University of Missouri, Completion Report, October 1979. 131 p, 30 fig, 25 tab, 79 ref, append. OWRT B-129-MO(2), 14-34-0001-9079.

Descriptors: *Soil water, *Salinity, Sodium, Salts, Hydraulic conductivity, Soil structure, Leaching, *Irrigation water.

The effect of different sodium absorption ratios (SAR) and salt concentrations on the saturated hydraulic conductivities for 18 soils ranging in base saturation from 26 to 94% was studied. Soils varied in their response to the salinity treatments and were classified as having either high, medium, low or no response. The soils most sensitive to changes in sodium and salt concentration had the lowest initial hydraulic conductivities and the highest clay contents. The soils which showed no response to the salinity treatments were very acid (pH 3.7-4.3). The relationship between the exchangeable sodium ratio (ESR) and the SAR of the final leachate was estimated and was almost identical to that given by the U.S. Salinity Laboratory staff (1954). The alternating current measurement of conductivity of electrolytic solutions are frequency (f) dependent due to electrode-electrolyte interactions which add a resistance known as the Warburg impedance to the true resistance. The true resistance is a function of the salt concentration and the mobility of ions in the soil. The two-component model of electrical conductance provides a method to evaluate the ionic diffusion coefficient from electrical conductance. A comparison of these results with the self-diffusion of 42K and 24NA shows that in most cases the two methods agree and provide useful estimates of the diffusion coefficients of these cations in soil.
W80-00635

EFFECTS OF ACID MINE DRAINAGE ON A SOUTHWESTERN PENNSYLVANIA STREAM,
California State Coll., PA. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-00684

3D. Conservation In Domestic and Municipal Use

LARGE ARRAY OF WATER CONSERVATION STRATEGIES FOR PIMA COUNTY, ARIZONA,
Army Corps of Engineers, Los Angeles, CA.
Pima Association of Governments 208 Project, Element 6, Tasks 6350 and 6360, Conservation Strategies and Program Development, May 1978, 75 p, 6 fig, 11 tab, 33 ref.

Descriptors: *Water management(Applied), *Water yield improvement, *Water conservation, *Alternate planning, *Comprehensive planning, Water resources development, Water supply, Hydrologic budget, Water utilization, Regional analysis, Water loss, Drainage area, Waste water disposal, Water allocation(Policy), Conjunctive use, Environmental effects, Pima County, Arizona.

In response to Task Report 6330 conclusions that water use and budget calculations in Pima County, Arizona indicate current water consumption by all users to be three times the dependable supply, the purpose of the present analysis is to identify and discuss a wide range of possible methods to reduce the amount of water lost from the overall water systems in Pima County. Accordingly, the water resource system of the region encompassing the Ajo, Avra and Altar, Upper and Lower Santa Cruz and Upper and Lower San Pedro areas is described through the identification of each of the components from supply, through use, to disposal in an attempt to illustrate how water is lost or consumed and what types of conservation programs are applicable. The impacts of certain conservation programs are identified and discussed where appropriate. (Tickes-Arizona)
W80-00648

3F. Conservation In Agriculture

WATER, FOOD, AND FIBER,
Soil Conservation Service, Washington, DC.
S. G. Boone.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2001-2012.

Descriptors: *Water management(Applied), *Fibers(Plant), *Agriculture, *Farm management, *Crop production, *Water resources development, Aquiculture, Foods, Irrigation, Drainage, Water utilization, Water supply, Land use, Pastures, Consumptive use, Rainfall.

Agriculture is the major consumer of water as well as the major land use in many nations, and as a result critical land and water resource problems are associated with programs which increase agricultural production. The world must double food production in the next 25-30 years; production of food and fiber requires great amounts of water. About 90% of human food comes from cultivated crops, principally cereals, which occupy some 10% of the earth's land area; grazing and pasture land occupy about 20%. Food and fiber production consume more water than other human uses, about 80% of all consumption. Over 60% of rainfall on the land surface is used by vegetation or evaporates directly into the atmosphere, while 65%-95% of water indomestic or industrial use returns to streams or underground reservoirs. World food production can be increased and water supplies conserved through water resources development measures, including: (1) more efficient use of available water by improved irrigation management, drainage, soil management, and fertilization; (2) improved production in rain-fed areas; (3) development of additional land which does not require large amounts of supplemental water; (4) developing new irrigated areas where water supplies and arable land exist; (5) aquaculture; (6) bettermanagement and use of ocean, lakes, and grazing land food resources; and (7) increasing productivity per unit resource input with improved technology. (Lynch-Wisconsin)
W80-00455

IRRIGATION MANAGEMENT IN DEVELOPING COUNTRIES: A SUGGESTED ACTION PROGRAMME,
Overseas Development Inst., London (England).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2539-2546.

Descriptors: *Developing countries, *Irrigation operation and maintenance, *Water management(Applied), *Water distribution, *Crop production, *Agriculture, *Planning, Irrigation, Agricultural extension, Training, Political constraints, Legal aspects, Priorities, Equity.

Recommendations of a workshop on Choices in Irrigation Management, organized by the Overseas Development Institute and held at Canterbury, United Kingdom September-October 1976, are presented. To achieve production and equity objectives through irrigation the major priority is not to construct new projects but to improve the operation and management of existing systems; this will increase domestic food supplies, conserve foreign exchange now spent on food imports, and improve income and security of a larger number of farmers. A seven-point program is recommended: (1) Evaluate current performance of irrigation and agriculture, considering political, organizational, and management factors, and farmer problems and incentives. (2) Reform irrigation staff management, with measures to improve prestige, morale, and performance, provision of adequate resources for operation and maintenance, and possibly creation of special technical cadres to coordinate water supply and planning and to provide advice. (3) Provide political and legal support of unpopular measures, such as redistributing among farmers. (4) Provide a strong agricultural extension service and water use training to farmers. (5) Create small irrigation groups within large irrigation schemes. (6) Intensify cropping and water use and expand the irrigated area. (7) Accord high political priority to improving irrigation operation and maintenance. (Lynch-Wisconsin)
W80-00481

CONSERVATION BENCH TERRACES FOR RICE IN A SUBHUMID CLIMATE,
Central Soil and Water Conservation Research Inst., Agra (India).
L. S. Bhushan.
Soil Science Society of America Journal, Vol. 43, No. 4, p 754-758, July-August 1979. 4 fig, 4 tab, 16 ref.

Descriptors: *Terracing, *Farm management, *Rice, *Subhumid climates, On-site investigations, Crops, Rainfall, Runoff, Water conservation, Water harvesting, Rain water, Agriculture, *India, Rain-fed farming, Conservation bench terraces.

Rain-fed crops in northern India produce less than the potential maximum due to moisture stress at

crucial stages of plant development. Research was initiated on a conservation bench terrace (CBT) system to evaluate its potential to increase water supply for increasing and stabilizing rice production on 2.5% sloping land in the subhumid climate. The width ratios of the contributing area to the collection area (terrace benches) were 0:1, 2:1, and 3:1. The contributing area was cropped with corn planted on the contour. Six years of research have shown that levelled benches received 0.25, 0.50, and 0.76 cu m/sq m of estimated runoff from the 1:1, 2:1, and 3:1 ratios, respectively. Consequently, measured soil water in the level benches was greater than the storage in level benches without a contributing area at the time of panicle emergence. The rice yields in the level benches with contributing areas were 21, 47, and 88%, respectively, greater on three ratios than yields on the level check without a contributing area. The 84% increase in rice grain yield on the 3:1 CBT was attributed to increased soil water content at panicle emergence. A major advantage of the CBT system was that chances of crop failure were reduced. The probability of obtaining rice yields of less than 1,400 kg/ha was decreased from 50% on level bench to 16% in level benches with a 3:1 ratio. Similarly, the probability of achieving yields greater than 3,500 kg/ha was 50% in the 3:1 CBT system and 0% in the level bench (NW). Total dry matter production for the 3:1 CBT system was 1.7 times greater than the level check. (Sims-ISWS)
W80-00595

IRRIGATION TECHNOLOGY FOR DESERT LAND RECLAMATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
E. V. Richardson, and V. A. Koelzer.
Advances in Desert and Arid Land Technology and Development, v. 1, Adli Bishay and Wm. G. McGinnies, eds. Harwood Academic Publishers, 1979, p 219-229.

Descriptors: *Irrigation systems, *Irrigation practices, *Irrigation efficiency, *Irrigation operation and maintenance, *Water management(Applied), *Cost benefit analysis, Sprinkler irrigation, Drip irrigation, Bubble irrigation, Surface irrigation, Land reclamation, Economic feasibility.

Successful irrigation of desert lands requires good water management which is difficult to obtain with surface irrigation systems. Sprinkler, drip, and bubble systems which often provide a more effective method of water management on desert arid soils are described and discussed here both in detail and in terms of some of the general advantages of the three systems in contrast to surface irrigation techniques. Based on the experiences and investigations of these authors in developing new croplands in Nebraska and Colorado, the following general conclusions are drawn: (1) center pivot irrigation systems provide an excellent method of obtaining good water management and large crop yields at relatively low overall costs for field crops such as beans, corn, sugar beet and cotton. The system is particularly well suited for rough ground and is a good method for soil types from sand to light soil. (2) Low head, closed conduit bubble systems have the advantages of low cost, simplicity of operation, low energy requirements and water savings when used on fruit trees and some vegetables. Although relatively uniform surfaces are required it can be engineered for fairly steep slopes devoid of large adverse breaks in grade. (3) On rough land where energy may not be a problem, trickle or drip techniques may be a good alternative to the bubble. (Tickes-Arizona)
W80-00641

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

ISOTOPE HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 857-864.

Descriptors: *Stable isotopes, *Radioisotopes, *Hydrology, *Environmental isotope techniques, *Tracers, *Groundwater, *Surface waters, Arid lands, Tritiu, Deuterium, Carbon radioisotopes, Oxygen, Instrumentation, Aquifers, Groundwater recharge, Groundwater movement, Lakes, Reservoirs, Sediment transport, Discharge(Water), Measurement, Methodology, Rivers, Estuaries, Mapping.

Stable and radioactive isotopes can be used to provide qualitative and quantitative information on flow and circulation of water within the hydrological cycle, usually through tracers. Techniques include environmental isotopes and artificial radioisotope and instrumental methods. The latter are usually applied to localized problems, while environmental isotope techniques, dependent upon natural labelling of water, are often used over large areas. This paper concentrates on environmental isotope methodology. Nuclear techniques are useful for both groundwater and surface water problems. Groundwater applications include source and area of recharge, flow velocity, time since recharge, leakage between aquifers, interchange between surface and groundwater systems, estimation of aquifer parameters, and groundwater inventory (especially valuable in arid regions). Surface water applications include discharge measurement, dynamics of lakes and reservoirs, leakage from hydraulic control structures, and sediment transport processes and rates in rivers and estuaries. The four most commonly used environmental isotopes are the stable isotopes deuterium and oxygen-18, and radioisotopes tritium and carbon-14. The first three, part of the water molecule, are the only real water tracers available; all others are present in a dissolved form and are subject to loss by precipitation, absorption, and exchange. Only three isotopic water species are of practical importance, H2 (16)0, HD(16)0, and H2(18)0. Case studies illustrate isotope hydrology. (Lynch-Wisconsin)
W80-00421

WATER FOR AGRICULTURE.
Food and Agriculture Organization of the United Nations, Rome (Italy).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 3, p 907-942.

Descriptors: *Agriculture, *Water supply development, *World Food Conference, *Irrigation, *Crop production, *Water resources development, Aquiculture, Fish farming, Data collections, Financing, Training, Near East, Latin America, Africa, Asia, Water management(Applied), United Nations, Rural areas, Soil management, Soil moisture, Developing countries.

The U.N. World Food Conference convened in 1974 in the midst of an acute weather-related global food crisis revealed deep-seated problems, and indicated urgent need for expanding food production in developing countries. A crucial factor was the difference in annual growth rate in food demand between developed countries (2.5%) and developing countries (3.5%), due mainly to faster population growth in the latter. The number of hungry people, 460 million in 1974, increased by 24 million by 1975, and is expected to increase by 12 million annually thereafter. Agricultural production can be increased by expanding the cultivated area, or by increasing yields per unit land through such inputs as fertilizers, improved crop varieties, plant protection, and mechanization; in many countries yield increase is the only alternative, and requires an adequate and timely water supply for success. Agricultural water development needs of Latin America, the Near East, Africa, and Asia are examined in regard to: (1) irrigation and drainage, (2) human resources and skills, (3) water supplies for rural settlement, and (4) aquaculture. Recommendations: (1) improve and expand irrigation systems, (2) improve soil moisture management, (3) protect land against flooding and waterlogging, and (4) introduce or expand fish rearing operations. Other important concerns are financing, advisory services, training, and education, planning, and institutional improvements. (Lynch-Wisconsin)
W80-00424

ENVIRONMENTAL ISSUES IN RIVER BASIN DEVELOPMENT,
United Nations Environment Program, Geneva (Switzerland).
For primary bibliographic entry see Field 2A.
W80-00433

RATIONAL METHODS OF FLOOD CONTROL PLANNING IN RIVER BASIN DEVELOPMENT,
Economic Commission for Europe (UN), Geneva (Switzerland).
For primary bibliographic entry see Field 6A.
W80-00435

METHODS FOR ESTIMATING GROUND WATER RESOURCES AND THE BALANCE OF SUBSURFACE WATERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 6B.
W80-00440

COMPUTERIZED OPTIMIZATION OF WATER RELEASES FROM RESERVOIRS,
Austrian Electrical Industries, Inc.
K. Fessl, A. Kalliauer, and G. Schiller
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1755-1770.

Descriptors: *Austria, *Computer models, *Reservoir releases, *Mathematical models, *Hydroelectric power, *Water management(Applied), Reservoirs, Water supply, Water demand, Dynamic programming, Multiple-purpose reservoirs, Reservoirs, Model studies, Irrigation

A mathematical model for use in reservoir management in Austria (specifically for reservoir releases) is designed as abstractly as possible for application to all conceivable management problems and is suitable for a nonlinear optimization method. In Austria all large reservoirs have been constructed for hydroelectric power generation, though they have also been used for flood control, flow improvement during low discharge periods, and tourism. The method described is also applicable to other uses of reservoir releases, such as irrigation or water supply. The computerized system has been used successfully with the Austrian reservoirs to adjust power generation to seasonal demand and production, coordinate production of the various power stations, and maintain high water levels for recreation. The storage system is visualized as a network in which reservoirs are nodes and flow control elements are branches. Nodes and branches are numbered, and an incidence matrix is used to express a relationship within the network. Pumping is considered negative flow. The optimization problem in the discharge variables involves linear constraints and a nonlinear objective function. An example is given of the Malta group of power stations in southern Austria, a large storage scheme incorporating seven hydro or pumping stations and six reservoirs. An extract from computer output is appended. (Lynch-Wisconsin)
W80-00445

THE ENVIRONMENTAL IMPACTS OF THE ASWAN HIGH DAM,
Academy of Scientific Research and Technology, Cairo (Egypt)
For primary bibliographic entry see Field 5C
W80-00446

THE PROJECTS FOR THE INCREASE OF THE NILE YIELD WITH SPECIAL REFERENCE TO JONGLEI PROJECT,

Nile Waters Dept., Khartoum (Sudan).
K. A. Mohamed.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1799-1830.

Descriptors: *Nile River, *Sudan, *Water conservation, *Hydraulic engineering, *Irrigation, *Water resources development, *Planning, Water supply development, Rivers, Egypt, Economics, Jonglei Canal Project(Sudan), Canals, Diversion structures, Machar marshes(Sudan), Sobat Basin(Sudan), Behr El Ghazal Basin(Sudan), Embankments, Swamps, River basin development, Behr El Jebel Basin(Sudan), Behr El Eraf Basin(Sudan), Dams, Regional planning.

Several joint Sudanese-Egyptian projects to reduce water losses in the swampy regions of the upper Nile River system in the Sudan are described. The projects encompass the basins of Behr El Jebel, Behr El Zeraf, Behr El Ghazal, Sobat, and the Machar marshes. Special attention is given to the Jonglei Canal Project in the Behr El Jebel and Behr El Zeraf Basins. An estimated 42 billion cu m of water are lost annually in the total area. This paper describes the hydrology of each basin and conservation measures planned, which include dams, diversion works, and embankments. At present Sudan's irrigation development is limited by the country's 18.5 billion cu m share of Nile waters; and additional 14 billion cu m are needed. In the Behr El Ghazal Basin all but 0.16 of the 13.97 billion cu m total annual average discharge is lost in the swamps. Three dams and a diversion canal will generate an estimated additional seven billion cu m. For the Sobat River Basin and Machar marshes some four billion cu m will be saved by proposed storage on the upper Baro River, banking of the Baro, and a diversion canal. The Jonglei Canal Project will divert part of the Behr El Jebel flow, which loses half of its discharge in the flanking swamps. West of the project area an estimated 3.7 million acres is suitable for irrigation. The project will also include banking works, use of Lakes Victoria, Kyoga, and Albert for long-term storage, and improving the carrying capacities of the two river channels. The water benefit will be 24.5 MM3/day after the second phase. (Lynch-Wisconsin)
W80-00447

REHABILITATION OF CATCHMENT AREAS IN MOUNTAIN REGIONS,
Bundesministerium fuer Wirtschaft, Bonn (Germany, F.R.)
G. Winckler.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2261-2266.

Descriptors: *Mountains, *Headwaters, *Soil erosion, *River basins, *Deforestation, *Environmental effects, Runoff, Gully erosion, Karst, Crop production, Pastures, Water management (applied), Land use, Planning, Watersheds (basins), Sedimentation, Sediment transport.

Agricultural production, animal husbandry, and timbering have intensified natural erosion in mountainous regions of the world and cause significant runoff resulting in further erosion, flood disasters, and sediment deposition. Such regions tend to have particularly high precipitation. Forests, the natural vegetation form in mountain areas, are being rapidly destroyed by fires, uncontrolled pasturing, and use of wood as fuel and timber. Deforestation results in gully and surface erosion and landslides. High discharge rates and volumes in headwaters cause deep washouts of river beds, slides of eroded banks, and soil transport; the latter leads to shallower river beds, shifting river courses, and flooding. Fertile soils is covered by sand, which also accumulates in irrigation and drainage facilities. With deforestation rainwater is no longer retained by the soil, and water reserves are unavailable for dry-weather periods; springs and rivers dry up, explaining the increasing occurrence of drought in these areas. The extension of agricultural production to marginal sites has drastically decreased soil fertility and caused erosion, including problems in areas where terrace irrigation using unsuitable methods is applied. To combat these problems, comprehensive land-use planning is needed, including vegetation conservation and restoration. At the global level attention must be drawn to increased karst development of mountain regions. (Lynch-Wisconsin)
W80-00469

EFFICACY, UPTAKE AND DISTRIBUTION OF DIFFERENT HERBICIDES IN THE WATER HYACINTH,
Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. for Phytomedicine.
For primary bibliographic entry see Field 5C.
W80-00519

URBAN STORMWATER POLLUTION: AN INVESTIGATION OF THE PROBLEM AND ITS CONTROL,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 5B.
W80-00525

PLANNING STATUS REPORT, WATER RESOURCES APPRAISALS FOR HYDROELECTRIC LICENSING: LOWER ARKANSAS RIVER BASIN-ARKANSAS, COLORADO, KANSAS, NEW MEXICO, OKLAHOMA AND TEXAS,
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation.
For primary bibliographic entry see Field 6D.
W80-00533

FLOOD HAZARD ANALYSES, LITTLE OSSIPEE RIVER, TOWNS OF ACTON, NEWFIELD AND SHAPLEIGH, MAINE, YORK COUNTY.
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W80-00535

FLOOD PLAIN INFORMATION: BAYOU BONFOUCA-BAYOU VINCENT W-14 MAIN DIVERSION CANAL DOUBLOON BRANCH-FRENCH BRANCH, SLIDELL, LOUISIANA AND VICINITY,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W80-00536

FLOOD PLAIN INFORMATION: OHIO RIVER, HANCOCK COUNTY, KENTUCKY,
Army Engineer District, Louisville, KY.
For primary bibliographic entry see Field 2E.
W80-00537

SPECIAL FLOOD HAZARD INFORMATION REPORT: TYGART RIVER, TAYLOR COUNTY, WEST VIRGINIA,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2E.
W80-00538

FLOOD PLAIN INFORMATION: OHIO RIVER, BOONE COUNTY, KENTUCKY,
Army Engineer District, Louisville, KY.
For primary bibliographic entry see Field 2E.
W80-00539

FLOOD PLAIN INFORMATION: BATON ROUGE, LOUISIANA, NO. 5, CYPRESS BAYOU AND TRIBUTARIES,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W80-00540

FLOOD PLAIN INFORMATION: BATON ROUGE, LOUISIANA, NO 4, HURRICANE CREEK, MONTE SANO BAYOU AND TRIBUTARIES,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W80-00541

GUIDELINES FOR URBAN DEVELOPMENT IN LOUISIANA'S COASTAL WETLANDS,
New Orleans Univ., LA. Urban Studies Inst.
For primary bibliographic entry see Field 4C.
W80-00547

IMPACT ASSESSMENT OF WATER RESOURCE DEVELOPMENT ACTIVITIES: A DUAL MATRIX APPROACH,
Fish and Wildlife Service, Kearneyville, WV. Water Resources Analysis.
For primary bibliographic entry see Field 6B.
W80-00550

OPTIMAL MANAGEMENT OF A MULTIRESERVOIR WATER SUPPLY SYSTEM,
IBM Scientific Center, Haifa (Israel).
S. Gal.
Water Resources Research, Vol. 15, No. 4, p 737-749, August 1979. 2 fig, 8 tab, 12 ref, 1 append.

Descriptors: *Water management(Applied), *Reservoirs, *Water supply, *Optimization, *Methodology, *Stochastic processes, *Dynamic programming, *Parameter iteration method, Water policy, Inflow, Equations, Pumping, Flood control, Costs, Simulation analysis, Constraints, Mathematical models, Systems analysis, Lake Kinneret(Israel).

Presented is a pilot study of a method for finding an approximation for the optimal policy of a dynamic system which depends on stochastic state variables. The systems considered are multi-reservoir water supply systems whose (stochastic) state variables are the quantities of water in each reservoir and some previous inflows which affect future inflows. Of special importance is the three-reservoir system which represents the major part of Israel's water supply system: Lake Kinneret and two underground aquifers. This system can be represented by five stochastic state variables: the quantities of water in each of the three reservoirs and the inflows into the Kinneret for the two previous months. Since this system is too large to be solved by the usual dynamic programming approach, a method was devised herein for obtaining an approximate solution which does not consume too much time or space. This method is referred to as the parameters iteration method. it has been tested on a smaller system containing only three stochastic state variables: the amount of water in the Kinneret and two previous monthly inflows. The results were satisfactory in the sense that the approximate solution obtained by this method was as good as the optimal solution obtained by a dynamic programming approach to the same problem. Thus it can be expected that the parameter iteration method would be efficient for the three reservoir problems as well as for larger ones. (Bell-Graf--Connell)
W80-00583

CONSERVATION BENCH TERRACES FOR RICE IN A SUBHUMID CLIMATE,
Central Soil and Water Conservation Research Inst., Agra (India).
For primary bibliographic entry see Field 3F.
W80-00595

4B. Groundwater Management

ISOTOPE HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 4A.
W80-00421

THE RESPONSE OF GROUNDWATER SYSTEMS TO DROUGHT,
Water Resources Commission, Sidney (Australia).
W. H. Williamson.
In: Water Management and Development, Proceedings of the United Nations Water Conference;

Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2125-2141.

Descriptors: *Droughts, *Australia, *Groundwater, *Aquifers, *Water supply, Groundwater recharge, Water management(Applied), Hydrogeology, Geology, Hydrology, Wells, Water sources, Surface waters, Water resources development, Planning, Arid lands, Water storage, Storage flow ratio, Salinity, Rainfall.

A review of several case histories, primarily Australian, of effects of drought on groundwater resources demonstrates that even where there is a substantial effect, groundwater is generally a far more reliable source than surface waters. Under favorable circumstances yields of bores or wells are relatively unaffected by drought, even though streams cease to flow and surface storages are dry. The concept of storage/flow ratios (storage upstream of a cross-section to flow past the section) offers a useful approach to characterizing the groundwater regime in terms of quantifying likely effects of a drought; a high ratio (expressed in years) indicates a drought will have little effect on groundwater. The ratio should be used in conjunction with the nature of the aquifer system and the pattern of recharge amount and frequency. Geology is the dominant factor influencing groundwater conditions, controlling an aquifer's storage volume, hydraulic characteristics, recharge and extraction rates, and usually strongly influences water quality. Geological formations can be grouped into three categories in terms of aquifers: (1) unconsolidated sediments, (2) porous rocks, and (3) fractured rocks. Climate, topography, vegetation, and soil cover also affect groundwater. Case histories include the Australian Capital Territory, Paroo calcrete, Weipa Peninsula, Gnangara sand beds, Great Australian Basin, and Hunter Valley in Australia, and Edwards limestone in Texas. (Lynch-Wisconsin)
W80-00462

METHODS OF GROUND-WATER PROTECTION FROM POLLUTION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. M. Goldberg.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2145-2161.

Descriptors: *Water pollution control, *Groundwater, *Aquifers, *Hydrogeology, *Wells, Industrial wastes, Fertilizers, Pesticides, Agricultural runoff, Domestic-wastes, Salinity, Effluents, Forecasting, Observations wells, Potable water, Permeability.

The principle sources of groundwater pollution are: (1) industrial wastes, especially industrial sewage; (2) domestic effluents and waste; (3) agricultural fertilizers and pesticides; and (4) natural unconditioned surface and ground waters. The latter contain high mineralization with components which exceed permissible drinking water standards. Industrial effluents are the most important source of groundwater contamination, especially surface waste reservoirs--settling tanks, sludge accumulation tanks, gold dumps, storage tanks, evaporation tanks, and tailing ponds. Fresh groundwater is of greatest concern, but waters of high mineralization may be responsible for salinization of fresh groundwater. The extent of groundwater pollution depends on thickness and permeability of deposits overlying the aquifer, as well as on groundwater depth, the ratio of pressure heads of the aquifer, and properties of the pollutant which may change rock structure and permeability. Methods of predicting groundwater contamination on and quality at water intakes are discussed. Measures for protecting groundwater from pollution include: (1) control of industrial siting with regard to hydrogeology, (2) creation of a network of observation wells to monitor contamination, (3) elimination of abandoned and flowing wells, (4) regulating groundwater withdrawal, (5) sanitary control at water intakes, (6) construction of a series of wells to intercept polluted groundwater, and (7) water injection into the aquifer. (Lynch-Wisconsin)
W80-00463

GROUND-WATER CONDITIONS AND POTENTIAL FOR ARTIFICIAL RECHARGE IN LUCERNE VALLEY, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
D. H. Schaefer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 349, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-118, January 1979. 37 p, 13 fig, 4 tab, 17 ref.

Descriptors: *Groundwater resources, *Water quality, *Aquifer characteristics, *Drawdown, *Irrigation, Water wells, Overdraft, Water levels, Hydrogeology, Groundwater availability, Water supply, Water utilization, Artificial recharge, Potential water supply, Planning, California, *Lucerne Valley, *San Bernardino County(CA).

The water level in two areas of Lucerne Valley in California has declined more than 100 feet since 1917, including 60 feet from 1954 to 1976. These declines are the result of pumping for the irrigation of alfalfa. The lowering of water levels has caused many shallow domestic wells to go dry. Well yields in the valley generally are between 10 and 1,000 gallons per minute. About 240,000 acre-feet of ground water was withdrawn between 1950 and 1976. About 1,750,000 acre-feet remains in storage. Water of poor quality underlies the valley around Lucerne Lake. There was no definable movement of this water from 1954 to 1976, but the possibility exists for future movement toward centers of pumping. Lucerne Valley may be hydrologically suitable for artificial-recharge operations. (Woodard-USGS)
W80-00763

GROUND WATER IN DALE VALLEY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
A. C. Randall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 804, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-120, 1979. 85 p, 17 fig, 7 tab, 29 ref.

Descriptors: *Aquifer management, *Artesian aquifers, *Glacial aquifers, *Computer models, *Saline water intrusion, Aquifer characteristics, Water wells, Pumping, Water yield, Drawdown, Water levels, Water supply, Projections, Water quality, Chemical analysis, New York, *Dale Valley(NY), *Wyoming County(NY).

Dale Valley is a broad valley segment, enlarged by glacial erosion, at the headwaters of Little Tonawanda Creek near Warsaw, New York. A thin, shallow alluvial aquifer immediately underlies the valley floor but is little used. A deeper gravel aquifer, buried beneath many feet of lake deposits, is tapped by several industrial wells. A finite-difference digital model treated the deep aquifer as two-dimensional with recharge and discharge through a confining layer. It was calibrated by simulating (1) natural conditions, (2) an 18-day aquifer test, and (3) 91 days of well-field operation. Streamflow records and model simulations suggest that in moderately wet years such as 1974, a demand of 750 gallons per minute could be met by withdrawal from the creek and from the aquifer without excessive drawdown at production wells or existing domestic wells. With reasonable but unverified model adjustments to simulate an unusually dry year, the model predicts that a demand of 600 gallons per minute could be met from the same sources. Water high in chloride has migrated from bedrock into parts of the deep aquifer. Industrial pumpage, faults in the bedrock, and the natural flow system may be responsible. (Woodard-USGS)
W80-00768

A PRELIMINARY APPRAISAL OF THE IMPACT OF AGRICULTURE ON GROUNDWATER AVAILABILITY IN SOUTHWEST GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
L. D. Pollard, R. G. Grantham, and H. E. Blanchard, Jr.
Geological Survey Water-Resources Investigations 79-7 (open-file report), October 1978. 22 p, 11 fig, 4 plates, 3 tab, 21 ref.

Descriptors: *Groundwater availability, *Water quality, *Agricultural chemicals, *Groundwater recharge, *Irrigation wells, Aquifer management, Pumping, Water yield, Evaluation, *Southwest Georgia.

Irrigated acreage in the 20-county study area in southwest Georgia increased from 130,000 acres in 1976 to 261,000 in 1977. Acreage irrigated entirely by ground water increased 85 percent for the same period. The largest quantity of ground water used for irrigation was in the Dougherty Plain district, where 92 percent of supplemental irrigation water comes from wells. The total amount of water pumped for irrigation in the Dougherty Plain in 1977 was more than 42 billion gallons, 30 billion gallons more than in 1976. There were no detectable concentrations of selected organic compounds and trace metals used in agricultural chemicals above the recommended limits for public consumption in 19 wells sampled for chemical analyses. Although nitrate concentrations were not above the recommended limits for drinking water, the presence of nitrate in amounts ranging from 0.3 to 7.8 milligrams per liter in wells in the Dougherty Plain possibly indicate the downward movement of soluble nitrate, a byproduct of fertilizer, into the ground-water reservoir. (Woodard-USGS)
W80-00770

4C. Effects On Water Of Man's Non-Water Activities

GUIDELINES FOR URBAN DEVELOPMENT IN LOUISIANA'S COASTAL WETLANDS,
New Orleans Univ., LA. Urban Studies Inst
A. J. Mumphrey, Jr., and J. S. Brooks.
Coastal Zone Management Journal, Vol. 4, No. 1/2, p 165-187, January-February 1978. 2 fig, 45 ref.

Descriptors: *Wetlands, *Flooding, *Louisiana, *Coastal environments, *Runoff, *Land drainage, *Coastal development, *Methodology, *Coastal zone management, Land use, Planning, Regulatory measures, Flood protection, Water pollution control, Aquatic habitat, Coastal areas, Water resources planning, Pollution, Urban development.

The authors present a methodology which is intended to be used by organizations interested in urban development of wetlands. The study does not recommend development in Louisiana's wetlands and flood prone areas, but discusses mitigating practices which might be employed in the development process which would minimize environmental damage. Recommended are familiarization with U.S. Army Corps of Engineers dredge and fill permitting practices and requirements of the National Environmental Policy Act. Also discussed in the construction phase are adding deep soil minerals to stabilize a site, selective clearing of vegetation to avoid severe erosion, use of sheet piling to avoid sinking in construction of roads next to canals, and use of sewer lines rather than septic tanks to avoid wetland soil contamination from sewage. Recommended flood protection guidelines include: restriction of uses to those having least impact, such as agriculture, public open space, and temporary uses; under permitted exceptions, allow only structures built to resist flooding, flotation and water seepage; designing drainage systems to minimize runoff; and institution of local solid waste programs to mitigate effects of processes such as dumping in sanitary landfills. (Arnold-NC)
W80-00547

THE IMPACT OF DREDGED HOLES ON OXYGEN DEMAND IN THE LOWER BAY, NEW YORK HARBOR,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
S. M. Swartz, and B. H. Brinkhuis.
Special Report 17, Reference 78-5, December 1978. 87 p, 18 fig, 18 ref, 2 append.

Descriptors: *Dredging, *Oxygen demand, *Circulation, *Sands, *Mining, Environmental effects, Resources development, Sediments, Bays, Organic matter, Ecosystems, *New York Harbor, Dredged holes, Environmental impact.

The purpose was to determine the effects, if any, of dredged holes in the seabed of the Lower Bay of New York Harbor on oxygen dynamics in the water column and surficial sediments. The data were collected during five cruises in the Lower Bay between February 1978 and August 1978. Samples of surficial sediments were analyzed for organic carbon, acid-soluble sulfide, and oxygen consumption rate. In addition, the water column at many of the stations was sampled at various depths to profile temperature, salinity, and dissolved oxygen. The results show that the presence of dredged holes affects oxygen demand of the sediments and oxygen concentrations of the overlying waters. These effects are variable, and dependent on the location of the dredged holes. Lower oxygen concentrations were generally found in dredged holes on the West Bank. There was no effect of dredged holes on oxygen dynamics on the East Bank. This difference is ascribed to hydrodynamic dissimilarities between the East and West Banks, and the accumulation of fine organic matter only on the West Bank. Bottom topography effects on circulation can be an important factor in controlling the dynamic balance between oxygen consuming processes in the sediments and water column, and physical processes in the water column which supply oxygen to the bottom waters. (NOAA)
W80-00694

EFFECTS OF URBANIZATION ON THE MAGNITUDE AND FREQUENCY OF FLOODS IN NORTHEASTERN ILLINOIS,
Geological Survey, Champaign, IL. Water Resources Div.
H. E. Allen, Jr., and R. M. Bejcek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 065, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-36, 1979. 48 p, 6 fig, 4 tab, 23 ref.

Descriptors: *Urbanization, *Flood frequency, *Flood discharge, *Peak discharge, *Illinois, Storm runoff, Flood forecasting, Analytical techniques, Estimating equations, Regression analysis, Gaging stations, Flow characteristics, Land use, Paving, Drainage area, Channel morphology, *Northeastern Illinois, Watershed characteristics.

Changes in land use associated with urbanization have increased flood-peak discharges in northeastern Illinois by factors up to 3.2. Techniques are presented for estimating the magnitude and frequency of floods in the urban environment of northeastern Illinois, and for estimating probable changes in flood characteristics that may be expected to accompany progressive urbanization. Suggestions also are offered for estimating the effects of urbanization on flood characteristics in areas other than northeastern Illinois. Three variables, drainage area, channel slope, and percent imperviousness (an urbanization factor), are used to estimate flood magnitudes for frequencies ranging from 2 to 500 years. Multiple regression analyses were used to relate flood-discharge data to the above watershed characteristics for 103 gaged watersheds. These watersheds ranged in drainage area from 0.07 to 630 square miles, in channel slope from 1.1 to 115 feet per mile, and in imperviousness from 1 to 39 percent. (Woodard-USGS)
W80-00769

STORMWATER-RUNOFF DATA FOR A COMMERCIAL AREA, BROWARD COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. A. Miller, H. C. Mattraw, Jr., and J. Hardee.
Geological Survey open-file report 79-982, 1979. 127 p, 2 fig, 4 tab, 7 ref.

Descriptors: *Storm runoff, *Paving, *Water quality, *Chemical analysis, *Rainfall-runoff relationships, Shopping center, Parking lot, Impervious area, Chemical load, *Fort Lauderdale(Fla).

Rainfall, stormwater discharge, and water-quality data for rainfall and runoff are summarized for a commercial area in Fort Lauderdale, Florida. Loads for 20 water-quality constituents were computed for runoff from 31 storms between May 1975 and June 1977. The basin of 20.4 acres contains a shopping center with adjacent parking, and is 97.9 percent impervious. (Woodard-USGS)
W80-00772

DETERMINATION OF PEAK DISCHARGE FROM RAINFALL DATA FOR URBANIZED BASINS, WICHITA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-00774

4D. Watershed Protection

REHABILITATION OF CATCHMENT AREAS IN MOUNTAIN REGIONS,
Bundesministerium fuer Wirtschaft, Bonn (Germany, F.R.)
For primary bibliographic entry see Field 4A.
W80-00469

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1978,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. R. Cruz.
Geological Survey open-file report 79-985, May 1979. 23 p, 10 fig, 5 tab, 3 ref.

Descriptors: *Groundwater resources, *Water wells, *Pumping, *Water yield, *Water quality, Water level fluctuations, Potentiometric level, Water analysis, Chemical analysis, Observation wells, Boreholes, Aquifer management, Military reservations, *White Sands Missile Range(NM).

Ground-water data were collected in 1978 at White Sands Missile Range in south-central New Mexico. Total ground-water pumpage in 1978 was 692,045,700 gallons or 7,248,300 less than in 1977. Wells at the Post Headquarters produced 98 percent of the total volume. Water levels in test wells around the Post Headquarters well field show seasonal declines ranging from 14.78 feet to 0.71 feet. The water samples collected from the supply wells show that the chemical quality of the water is slightly better during the period of greatest declines. (Woodard-USGS)
W80-00764

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

THE USE OF THE ATP ASSAY FOR RAPID ASSESSMENT OF WATER QUALITY,
Dearborn Chemical Co. Ltd., Ottawa (Ontario). Dearborn Environmental Consulting Services.
Fisheries and Environment Canada. Inland Waters Directorate, Water Quality Branch, Ottawa, Canada. 1979. Technical Bulletin No. 109. 181 p, 44 fig, 40 tab, 105 ref, 3 append.

Descriptors: *Water quality, *Adenosine-triphosphate(ATP) assay, *Chlorination, *Analytical techniques, *Wastewater quality, Methodology, Biochemical oxygen demand, Assay, Laboratory tests, Water quality control.

This is a report on the evaluation of the feasibility of applying the adenosine triphosphate (ATP) assay to provide a more rapid indication of water quality and wastewater quality. The long term incubation times involved in standard bacterial enumeration methods and the biochemical oxygen demand (BOD5) methodology limit the applicability of these analytical results for process control; therefore, a short-term alternative is being sought. A comparison of ATP extraction methodology indicated that the boiling glycine and the homogenizing ATP extraction methods are more accurate and more precise than either the acetone-tris or acetone-tris-MgEDTA methods. The boiling glycine method is more applicable than the homogenizing method for field use. The ATP content of secondary effluent streams disinfected with chlorine was found to be significantly correlated with the results of conventional bacterial plating methods when the disinfection efficiency was varied over a wide range (50 to >99.99 percent kill). However, the relative response of the ATP assay and the plate counts differed by several orders of magnitude. The residual ATP content provided a better estimate of disinfected effluent quality and would appear to be a more meaningful process control parameter. Care must be exercised in the interpretation of ATP assay results and considerable knowledge concerning the response of the system to various inputs is necessary. (Iervolino-NC)
W80-00552

WATER QUALITY INVESTIGATION OF ESTUARIES OF GEORGIA, 1976,
Brunswick Junior Coll., GA.
For primary bibliographic entry see Field 2L.
W80-00553

PERSISTENCE OF CHLORINE IN COOLING WATER FROM ELECTRIC GENERATING STATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
G. F. Lee.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE4, Proceedings Paper 14777, p 757-773, August 1979. 9 fig, 6 tab, 6 ref, 1 append.

Descriptors: *Chlorine, *Cooling water, *Delaware River, Sampling, Chemical analysis, Thermal pollution, Thermal water, Heated water, Toxins, Fish toxins, Toxicity, Fouling, Powerplants, Rivers, Water pollution, Thermal plumes.

A study of the persistence of chlorine in the cooling water discharged to the Delaware River estuary by the Philadelphia Electric Company Eddystone Generating Station showed that potentially toxic levels of chlorine were present 1 hr to 2 hr after discharge for organisms (plankton) entrained in the thermal discharge plume. Based on consideration of chlorine persistence-time of exposure relationships that exist in cooling water thermal plumes, little or no toxicity would be expected to fish in the Delaware River due to the use of chlorine for condenser fouling control at the Eddystone Electric Generating Station. (Sims-ISWS)
W80-00581

TRACE ANALYSIS OF PHOSPHATES IN SMALL AQUEOUS VOLUMES,
Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Chemical Engineering.
W. Potman, and L. Lijklema.
Water Research, Vol. 13, No. 8, p 801-804, 1979. 1 fig, 5 tab, 7 ref.

Descriptors: *Phosphates, *Chemical analysis, *Connate water, Chemicals, Phosphorus, Phosphorus compounds, Analytical techniques, Equipment, Instrumentation, Aqueous solutions, Sediments, Water chemistry, Laboratory tests, Chemistry, Nutrients, Pollutants, Pollutant identification, Water pollution.

The indirect determination of trace amounts of phosphate through estimation of the molybdenum in the phosphomolybdic acid complex has been improved. The lower limit of spectrophotometric determination is about 0.10 microgram P. (Sims-ISWS)
W80-00589

RATE CONTROLLING PROCESSES IN THE RELEASE OF RADIUM-226 FROM URANIUM MILL TAILINGS, I. LEACHING STUDY,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5B.
W80-00600

RATE CONTROLLING PROCESSES IN THE RELEASE OF RADIUM-226 FROM URANIUM MILL TAILINGS, II. KINETIC STUDY,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5B.
W80-00601

DEGRADATION OF SELECTED POLYCYCLIC AROMATIC HYDROCARBONS IN COASTAL SEDIMENTS: IMPORTANCE OF MICROBES AND POLYCHAETE WORMS,
Skidaway Inst. of Oceanography, Savannah, GA.
W. S. Gardner, R. F. Lee, K. R. Tenore, and L. W. Smith.
Water, Air, and Soil Pollution, Vol. 11, No. 3, p 339-347, April 1979. 4 fig, 3 tab, 25 ref. NOAA 10-32-RR273-07 7.

Descriptors: *Sediments, *Coasts, *Microbial degradation, *Worms, Marine microorganisms, Marine biology, Organic compounds, Oil spills, Pollutants, Path of pollutants, Laboratory tests, Chemicals, Chemical analysis, Water pollution, Water quality, Polychaete worms, Polycyclic aromatic hydrocarbons.

Rates of degradation of polycyclic aromatic hydrocarbons (PAH) were examined after addition of crude oil enriched with anthracene, fluoranthene, benz(alpha)anthracene, and benzo(alpha)pyrene to coastal sediments in a laboratory (20 deg C) flowing seawater system. Three types of sediment (fine sand, medium sand, and marsh sediment) with and without the benthic polychaete worm, Capitella capitata, were used. After extraction from the sediment, PAH concentrations were measured by liquid chromatography with fluorescent detection. Microbial degradation was studied by incubating sediments with radioactive PAH and measuring subsequent production of 14CO2. Concentrations of the four PAH decreased significantly with time in fine and medium sized sands. PAH levels also decreased in marsh sediment, but trends were not significant (P less than 0.05). C. capitata stimulated PAH degradation. Microbial degradation was more rapid in upper surfaces than in lower layers of the sediments. (Sims-ISWS)
W80-00613

A COMPARISON OF DYNAMIC AND STATIC HEAD SPACE AND SOLVENT EXTRACTION TECHNIQUES FOR THE DETERMINATION OF TRIHALOMETHANES IN WATER,
Environmental Health Directorate, Ottawa (Ontario). Bureau of Chemical Hazards.
R. Otson, D. T. Williams, and P. D. Bothwell.
Environmental Science and Technology, Vol. 13, No. 8, p 936-939, August 1979. 5 tab, 12 ref.

Descriptors: *Water chemistry, *Pollutant identification, *Analytical techniques, Chemical analysis, Laboratory tests, Solvent extractions, Chemicals, Potable water, Water quality, Chemistry, Water pollution, *Trihalomethanes.

The dynamic head space (GS), solvent (hexane) extraction (SE), and static head space (HS) techniques utilizing Tenax GC columns, a 63Ni electron capture detector, and a Hall electrolytic conductivity detector were compared for the determination of trihalomethanes (THMs) in water. Potable water samples ranging from 29 to 150 microgram/liter CHCl3, from 2.3 to 10.1 microgram/liter CHBrCl2, and from less than 0.5 to 1.8 microgram/liter CHBr2Cl were analyzed in triplicate. The relative standard deviation between THM values obtained by the three techniques was 9-10% for CHCl3, 3-24% for CHBrCl2, and 13-61% for CHBr2Cl. Although the GS technique was the most sensitive, the SE technique gave comparable precision, while the HS technique showed relatively poor precision and sensitivity. The SE technique was recommended for routine monitoring since it requires no special equipment and allows more analyses/hour than the GS technique. (Sims-ISWS)
W80-00617

POLYCHLORINATED BIPHENYLS AND CHLORINATED PESTICIDES IN SOILS OF THE EVERGLADES NATIONAL PARK AND ADJACENT AGRICULTURAL AREAS,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
A. G. Requejo, R. H. West, P. G. Hatcher, and P. A. McGillivary.
Environmental Science and Technology, Vol. 13, No. 8, p 931-935, August 1979. 2 fig, 4 tab, 31 ref. NPS 52 97-1008-182.

Descriptors: *Polychlorinated biphenyls, *Chlorinated hydrocarbon pesticides, *Swamps, *Agricultural chemicals, *Florida, Pollutants, Pollutant identification, Path of pollutants, Soils, Sediments, Soil contamination, Sampling, Chemical analysis, Pesticides, Farm wastes, Farm practices, Agriculture, *Everglades National Park.

Soil samples collected from the eastern Everglades National Park and adjacent farmlands were analyzed for certain chlorinated pesticides and polychlorinated biphenyls (PCBs). The results indicate that although concentrations of PCBs, 1,1,1-trichloro-2,2 bis(p-chlorophenyl) ethane (DDT), and chlordane are high at the agricultural sites, little contamination of parklands has occurred. Pesticide concentrations decrease by two orders of magnitude (to unit parts per billion levels) within 2 km of the agricultural sites sampled. Individual contributions of four Aroclors (1242, 1248, 1254, and 1260), calculated using pattern recognition techniques, suggest that plastic sheeting used in agricultural fields is a local source of PCBs. A comparison of the results to those from other environments revealed that PCB and DDT concentrations found within the Park (less than 1.0-33 and less than 1.0-22 ppb, respectively) are as low as any site in North America. (Sims-ISWS)
W80-00618

WATER QUALITY IN CHANNEL CATFISH PRODUCTION PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd, R. P. Romaire, and E. Johnston.
Journal of Environmental Quality, Vol. 8, No. 3, p 423-429, July-September 1979. 9 fig, 4 tab, 12 ref.

Descriptors: *Ponds, *Alabama, *Fish, *Channel catfish, *Water quality, Sampling, On-site investigations, Data processing, Chlorophyll, Secchi disks, Algae, Phytoplankton, Nitrates, Nitrogen, Nitrogen compounds, Ammonia, Carbon dioxide, Chemical oxygen demand, Phosphorus, Dissolved oxygen, Mathematical models, *Auburn(AL).

A number of water quality variables were measured at 1- to 2-week intervals in five channel catfish production ponds at Auburn, Alabama, during the 1978 growing season. Concentrations of most variables increased with time since feeding rates were progressively increased as fish grew. The DO concentration at dawn was often lower than 2.0 mg/liter during August and September. Emergency aeration was used one or more times in each pond to minimize the danger of fish kills because of low DO. In addition, unionized ammonia (NH3) and carbon dioxide concentrations were occasionally high enough to possibly have had adverse effects on fish. A computer simulation model for predicting the early morning DO concentration in ponds proved efficient. The average difference between measured and predicted DO concentration, disregarding sign, was 0.47 mg/liter for 30 trials. Spillway discharge from channel catfish ponds was more concentrated in pollutants than streams near Auburn. (Sims-ISWS)
W80-00619

CHEMICAL SEEPAGE FROM A TAIL WATER RECOVERY PIT TO ADJACENT GROUND WATER,
Nebraska Univ., Lincoln. Inst. of Agricultural and Natural Resources.
For primary bibliographic entry see Field 5B.
W80-00621

SEDIMENT AND NUTRIENT YIELD FROM RESIDENTIAL CONSTRUCTION SITES,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W80-00622

A WATER QUALITY STUDY OF A STRETCH OF THE RIVER TIGRIS,
Mosul Univ. (Iraq). Coll. of Engineering.
T. A. Mahmoud, and S. Ahmad.
Water Research, Vol 13, No 8, p 785-790, 1979. 5 fig, 2 tab, 6 ref.

Descriptors: *Water quality, *Sampling, *Water pollution, Pollutants, Pollutant identification, Sewage, Effluents, Sewage effluents, Waste water disposal, Chemical analysis, Biochemical oxygen demand, Dissolved oxygen, Model studies, Mathematical models, Path of pollutants, *Tigris River(Iraq), *Iraq.

A water quality study was conducted on a stretch of the River Tigris in Iraq near the city of Mosul for qualitative and quantitative assessment of pollution due to raw wastewater discharge from a number of outfalls located along its banks. A stretch of 18 km of the river was divided into a number of sections, and each section was divided into a number of strips along the direction of flow. The strip technique was adopted for comparing the observed and calculated values of dissolved oxygen and for identifying abnormalities. For theoretical analysis, three available mathematical techniques, namely, Streeter-Phelps, Dobbins modification of Streeter-Phelps, and the Rational method, were utilized. Due to poor dispersion and improper mixing of the wastewater and river water, a considerable stretch of the river close to the west bank is polluted, which adversely affects the aesthetic and cultural use of the water front. However, the results indicated that the river Tigris as a whole recovers from the effects of raw wastewater discharges. (Sims-ISWS)
W80-00623

WEAK AND STRONG ACIDS IN THE SURFACE WATERS OF THE TOVDAL REGION IN S. NORWAY,
Central Electricity Generating Board, Leatherhead (England). Research Lab.
For primary bibliographic entry see Field 2K.
W80-00624

EVALUATION OF AN ENZYMATIC METHOD FOR ORTHOPHOSPHATE DETERMINATION IN FRESHWATERS,
Ministry of Agriculture, Crumlin (Northern Ireland). Freshwater Biological Investigation Unit.
R. J. Stevens.
Water Research, Vol 13, No 8, p 763-770, 1979. 5 fig, 4 tab, 29 ref.

Descriptors: *Pollutant identification, *Phosphates, *Freshwater, *Chemical analysis, Analytical techniques, Laboratory tests, Water chemistry, Enzymes, Chemicals, Chemistry, Pollutants, Water pollution.

An automated enzymatic method for orthophosphate determination was applied to freshwaters. The basis of the assay was the reaction of glyceraldehyde-3-phosphate with orthophosphate to form 1,3-diphosphoglycerate in the presence of glyceral-

dehyde-3-phosphate dehydrogenase and oxidized nicotinaminde-adenine dinucleotide. Nicotinamide-adenine dinucleotide. Nicotinamide-adenine dinucleotide, reduced form was produced in equimolar amounts to orthophosphate and was determined colorimetrically. The method was tested up to 200 micrograms P/1 and had a limit of detection of 5 micrograms P/1. Silicate or arsenite did not interfere, but arsenate caused a positive interference. The results of the analysis of 100 fresh-water samples by the enzymatic orthophosphate method and the well-established soluble reactive phosphorus method indicated that a form of phosphorus was present which was determined as soluble reactive phosphorus but not as enzymatic orthophosphate. The mean soluble reactive phosphorus concentration was 71 micrograms P/1. A hydrous ferric oxide-orthophosphate complex was postulated to explain why soluble reactive phosphorus was greater than enzymatic orthophosphate. (Sims-ISWS)
W80-00625

TIME SERIES ANALYSIS OF AMMONIA IN THE PASSAIC RIVER,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W80-00638

A HISTORY OF MERCURY LEVELS IN SWEDISH FAUNA,
Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology.
A. Johnels, G. Tyler, and T. Westermark.
Ambio, Vol. 8, No. 4, p 160-168, 1979. 10 fig, 2 tab, 64 ref.

Descriptors: *Mercury, *Path of pollutants, Industrial wastes, Chemical wastes, Regulation, Heavy metals, Food chains, Seasonal, Water chemistry, Animal metabolism, Toxicity, Birds, Plant physiology, Fish physiology, *Sweden, *Tissue analysis, *Bioaccumulation, Finland.

The present article primarily describes research regarding levels of mercury in Swedish fauna and flora, with a concentration on higher animals. Particular emphasis is laid on the increase of levels from the 19th century to the present (the last 150 years) caused by increased industrial activity. The decrease since 1966, which is due to Finnish-Swedish regulations and prohibitions in the use of mercury and its compounds, is also discussed. Mercury in industrial emissions and its long range transport and deposition still pose a threat to fauna which feed on aquatic organisms. (Deal-EIS)
W80-00649

THE RESPONSE OF COHO SALMON AND GUPPIES TO 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD) IN WATER,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forestry Sciences Lab.
R. A. Miller, L. A. Norris, and B. R. Loper.
Transactions of the American Fisheries Society, Vol. 108, p 401-407, 1979. 1 fig, 4 tab, 11 ref.

Descriptors: *Sockeye salmon, *2,4,5-T, *Pesticide toxicity, Bioassay herbicides, Toxicity, Growth rates, Fish physiology, Animal pathology, Fish diseases, Mortality, Growth stages, Path of pollutants, Mode of action, *TCDD, *Dioxin, *Guppies, Fin disease.

TCDD exposure for 96 hours at 0.54 ng/g (amount of TCDD in test container per gram of wet body weight) had no effect on food consumption, weight gain, or survival of young coho salmon (Oncorhynchus kisutch) during a 60-day postexposure period in a static-water toxicity test. Growth and survival 114 days after exposure to 5.4 ng/g TCDD were reduced, and the reductions were greater after 24 hours than after 12 hours exposure to TCDD. These effects were first observed 56 days after exposure. The body burden of TCDD in young coho salmon 114 days after exposure increased with both the level and duration of exposure. The half-life of the whole-body TCDD residues was at least 109 days after fish were placed in clean water. Guppies (Poecilia reticulata) exposed to 0.8 ng TCDD/g developed fin disease 42 days after exposure. There was a significant decrease in the diseased fin condition between 42 to 69 days after exposure. Guppies had no increase in fin disease after exposure to 0.08 ng/g TCDD. (Deal-EIS)
W80-00651

ACCLIMATION TO AMMONIA BY TILAPIA AUREA,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
B. D. Redner, and R. R. Stickney.
Transactions of the American Fisheries Society, Vol. 108, p 383-388, 1979. 2 tab, 30 ref.

Descriptors: *Ammonia, *Tilapia, Bioassay, Toxicity, Lethal limit, Mortality, Cytological studies, Fish physiology, Fish diseases, Animal pathology, Water chemistry, Dissolved oxygen, Aquiculture, *Acclimation, *Tissue analysis.

An automatic flow-through dosing apparatus was used to determine the effect on Tilapia aurea of acute and chronic exposure to un-ionized ammonia. For fish not exposed to ammonia prior to acute testing, the 48-hour median lethal concentration (LC50) was 2.40 mg/liter un-ionized ammonia. After fish were exposed to sublethal concentrations of un-ionized ammonia (0.43-0.53 mg/liter) for 35 days, concentrations as high as 3.4 mg/liter caused no mortalities within 48 hours. Histopathological changes occurred in the gills of fish given both nonlethal and acute doses of ammonia. Capillary congestion, hemorrhaging, and telangiectasis were common symptoms of gill abnormalities. (Deal-EIS)
W80-00653

THE SURVIVAL OF SMOLTS OF SALMON SALMO SALAR L. AT LOW CONCENTRATIONS OF DISSOLVED OXYGEN,
Water Pollution Research Lab., Stevenage (England).
J. S. Alabaster, D. G. Shurben, and M. J. Mallett.
Journal of Fish Biology, Vol. 15, p 1-8, 1979. 3 fig, 2 tab, 12 ref.

Descriptors: *Atlantic salmon, *Mortality, *Dissolved oxygen, Bioassay, Smolt, Oxygen requirements, Salinity, Estuaries, Toxicity, Sea water, Fish physiology, Fish migration.

The survival of Atlantic salmon smolts on sudden exposure to low constant concentrations of dissolved oxygen (DO) has been measured under laboratory conditions. The 3-d LC50 is about 3 mg/l in freshwater and about 2.5 mg/l in 30% and 80% sea water, even for fish acclimated for several days to low concentrations of DO and high salinity. Median threshold concentrations of DO are probably close to 3.3 and 2.6 mg/l respectively. (Deal-EIS)
W80-00655

TOTAL AND METHYLMERCURY LEVELS IN THREE SPECIES OF WHELKS,
Shimonoseki Univ. of Fisheries (Japan). Dept. of Food Science and Technology.
T. Ueda, and M. Takeda.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 6, p 763-769, 1979. 10 fig, 7 tab, 8 ref.

Descriptors: *Mercury, *Animal physiology, Animal metabolism, Crustaceans, Absorption, Heavy metals, Chemical analysis, Path of pollutants, Water chemistry, Statistical analysis, Molluscs, Japan, *Tissue analysis, *Bioaccumulation, *Methylmercury.

Determination of the total and methylmercury levels were carried out on muscle and midgut from three species of whelks, Buccinum tenuissimum Buccinum striatissimum, and Buccinum tsubai, caught in the southwestern waters of the Japan Sea. Both total and methylmercury levels depend on the number of operculum circulii. There is a linear relationship between the total mercury concentration (T-Hg) in the muscle and that in the mid-gut, where the first regression coefficient (m) was about 2. A similar relationship was found between the methylmercury concentrations (MeHg) in the two tissues, though the m was 1.29. The ratio of T-Hg to MeHg in the muscle was 1:0.95, whereas it was 1:0.65 in the mid-gut. These facts suggest the demethylation from methylmercury in the mid-gut. (Deal-EIS)
W80-00656

TRACE METALS IN SEADUCKS OF THE FRASER RIVER DELTA INTERTIDAL AREA, BRITISH COLUMBIA,
Canadian Wildlife Service, Delta (British Columbia).
K. Vermeer, and D. B. Peakall.
Marine Pollution Bulletin, Vol. 10, p 189-193, 1979. 1 fig, 5 tab, 20 ref.

Descriptors: *Metals, *Greater Scaup Duck, *Animal physiology, Path of pollutants, Silver, Copper, Lead, Zinc, Mercury, Food habits, Sewage effluents, Outlets, Chemical analysis, Intertidal areas, Bioindicators, Toxicity, *Surf scoter duck, *Tissue analysis, *Bioaccumulation, British Columbia, Fraser River.

Surf Scoters and Greater Scaup and samples of species which comprise the major part of their diets, from Iona Island and Roberts Bank tidal flats, near Vancouver, British Columbia, were analyzed for metal residues. Significantly higher silver, copper, lead and zinc levels were found in Greater Scaup than Surf Scoters. The latter species had higher mercury levels. Differences in residue levels between the species reflect interspecific variation in prey as well as feeding habitat. Significantly higher silver, mercury, lead and zinc in Surf Scoters and silver and lead in Greater Scaup observed at Iona Island than at Roberts Bank can be explained by higher levels of those metals occurring in a more metal-contaminated prey and sediment near the Iona Island sewer outfall. Ducks feeding on organisms in different intertidal zones show different accumulation of metal residues and constitute valuable indicators of pathways of toxic chemicals in specific estuarine regions. (Deal-EIS)
W80-00657

THE CONCENTRATION AND SPECIATION OF ARSENIC IN MARINE MACRO-ALGAE,
Skidway Inst. of Oceanography, Savannah, GA.
J. G. Sanders.
Estuarine and Coastal Marine Science, Vol. 9, p 95-99, 1979. 2 tab, 17 ref.

Descriptors: *Arsenic compounds, *Marine algae, Phaeophyta, Chlorophyta, Rhodophyta, Chemical analysis, Metabolism, Cytological studies, Path of pollutants, Absorption, Chemical reactions, Organic arsenic, *Arsenic, Inorganic arsenic.

Arsenic concentration of marine algae varies significantly, ranging from an average of 10.3 microgram/g in the Phaeophyceae to 1.54 microgram/g in the Chlorophyceae and 1.43 microgram/g in the Rhodophyceae. The chemical speciation is also significantly different, with the Phaeophyceae containing an average of 22% inorganic arsenic, and the Chlorophyceae and Rhodophyceae containing about 45% inorganic arsenic. The absolute concentration of inorganic arsenic is not significantly different between the classes, however, and may represent maximum tolerable levels for macro-algae. The variations in arsenic concentration are probably due to metabolic differences between classes, and not to differences in the amount of total available arsenic in the surrounding water. (Deal-EIS)
W80-00658

ELECTRIC FISH AS A TOOL FOR WATER QUALITY ASSESSMENT,
City Coll., New York.
P. Grove, and P. Moller.
Transactions of the American Fisheries Society, Vol. 108, p 420-421, 1979. 1 tab, 7 ref.

Descriptors: *Bioindicator, *Dieldrin, Methodology, Bioassays, Pesticide toxicity, Pesticide residues,

Fish physiology, Water quality, Chlorinated hydrocarbon pesticides, Fish behavior, *Malathion, *Brienomyrus, *Electric fish.

The temporal pattern of electric organ discharges emitted by a mormyrid fish, Brienomyrus niger, was affected by two broad spectrum insecticides, dieldrin and malathion, in concentrations of 1 microgram/liter. Such discharge patterns have potential as a sensitive and convenient bioassay tool. Further investigation is required to determine if the effects on discharge activity are pesticide-specific and concentration-dependent. (Deal-EIS)
W80-00659

SENSITIVITY OF ALASKAN FRESHWATER AND ANADROMOUS FISHES TO PRUDHOE BAY CRUDE OIL AND BENZENE,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
A. Moles, S. D. Rice, and S. Korn.
Transactions of the American Fisheries Society, Vol. 108, p 408-414, 1979. 1 fig, 3 tab, 24 ref.

Descriptors: *Toxicity, *Oil, *Growth stages, *Fish physiology, Bioassays, Juvenile growth stage, Salmonids, Pink salmon, Sockeye salmon, Chinook salmon, Lethal limit, Mortality, Water chemistry, Water temperature, Fish eggs, *Crude oil, *Benzene, *Sculpins, *Sticklebacks.

The sensitivity of various species and life stages of Alaskan freshwater and anadromous fishes to benzene and the water-soluble fraction of Prudhoe Bay crude oil was determined with 96-hour toxicity tests. Freshwater juveniles of the six salmonid species tested has similar sensitivities. Median tolerance limits (TLm's) of these salmonids for crude oil ranged from 2.7 to 4.4 mg/liter; TLm's of benzene ranged from 11.7 to 14.7 microl/liter. Threespine sticklebacks and, to a lesser extent, slimy sculpins were more tolerant than salmonids and had larger TLm's: threespine sticklebacks had a crude-oil TLm of 10.4 mg/liter and a benzene TLm of 24.8 microl/liter. Eggs of pink salmon and coho salmon were quite tolerant to crude oil (TLm > 12 mg/liter) and benzene (TLm = 339-542 microl/liter). Emergent fry were the most sensitive freshwater stage (crude-oil TLm = 8.0 mg/liter; benzene TLm = 12.3-17.1 microl/liter). Out-migrant salmonids tested in seawater were twice as sensitive as out-migrant salmonids tested in freshwater, apparently because of the additional stress of entering seawater and the physiological changes associated with this transition. Freshwater TLm's were 2.3-8.0 mg/liter for crude oil and 10.8-17.1 microl/liter for benzene. Corresponding seawater sensitivities were 1.1-3.6 mg/liter for crude oil and 5.5-8.5 microl/liter for benzene. (Deal-EIS)
W80-00660

THE SOURCE OF MUDDY ODOR IN BREAM (ABRAMIS BRAMA) FROM THE PORVOO SEA AREA (GULF OF FINLAND),
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
P.-E. Persson.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 883-890, 1979. 5 fig, 2 tab, 54 ref.

Descriptors: *Cyanophyta, *Eutrophication, *Actinomycetes, *Odor-producing algae, Nutrients, Water temperature, Commercial fish, Phytoplankton, Odor, Seasonal, Nitrogen, Phosphorus, Biomass, Water chemistry, Gulf of Finland, *Geosmin, *Bream.

The study area was a shallow, extremely eutrophic, somewhat brackish water bay on the south coast of Finland. Muddy odor in bream (Abramis brama) was significantly correlated with the amount of the blue-green alga Oscillatoria agardhii occurring in the phytoplankton. Cultures dominated by this alga contained the muddy odor compound, geosmin. The high concentrations of O. agardhii in the study area were caused by several interacting factors, of which the high nutrient concentration and the temperature of the water seemed to be especially important. Odoriferous actinomycetes isolated from the water produced the muddy odor compounds gwosmin and 2-methylisoborneol, but there seemed to be a lag time of several weeks between maximal concentrations of actinomycetes and development of off-flavors in the fish. (Deal-EIS)
W80-00661

EFFECTS OF BOTTOM SEDIMENTS ON THE SURVIVAL OF ENTEROBACTER AEROGENES IN SEAWATER,
Chinese Univ. of Hong Kong. Dept. of Biology.
K.-Y. Chan, S. H. Wong, and C. Y. Mak.
Marine Pollution Bulletin, Vol. 10, p 205-210, 1979. 5 fig, 2 tab, 27 ref.

Descriptors: *Bottom sediments, *Nutrients, *Coliforms, Bacteria, Particle size, Sediments, Bioindicator, Domestic wastes, Cytological studies, Growth rates, Sea water, Marine bacteria, Chemical analysis, *Enterobacter.

The survival of the coliform bacterium Enterobacter aerogenes in seawater was greatly affected by the underlying bottom sediments. The presence of sediments which contained higher concentrations of organic nutrients than the overlaying seawater prolonged the survival and even enabled growth of the bacterial cells. Results obtained from chemical analysis indicated that sediments of fine-grained, silt-clay type contained highest amounts of organic nutrients as compared with sediments with larger particle sizes such as silt and sand grains. Thus, nutrient contents of the sediments were found to be inversely proportional to sediment particle size. The degree of prolonged survival of E. aerogenes was also found to be inversely proportional to the size of the sediment particles presented. Release of the bound nutrients which became available to cells of E. aerogenes from sediments by action of waves and human activities can explain, at least in part, why high counts of coliform bacteria are obtained in coastal and beach waters. (Deal-EIS)
W80-00662

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH-V EFFECTS ON CALCIUM AND INORGANIC PHOSPHORUS EXCRETION IN THE CARP,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
J. Koyama, and Y. Itazawa.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 6, p 691-694, 1979. 2 fig, 2 tab, 9 ref.

Descriptors: *Cadmium, *Fish physiology, *Toxicity, Animal metabolism, Calcium, Phosphorus, Heavy metals, Chlorides, Chemical analysis, Fish diets, Carp, *Teratogens.

The excretion rate of calcium increased in cadmium-administered carp, during the calcium-loaded period after its injection, owing not to elevation of calcium concentration in the urine but to the increased urine flow. The scoliosis developed in cadmium administered carp as detailed in the previous paper was considered to be attributable to low calcium in both the plasma and vertebrae. The low calcium was estimated to be due to overexcretion of calcium owing to degeneration of the renal tubules. The results of the present experiment seem to give support to the inference. Excretion of inorganic phosphorus in cadmium administered carp increased in both concentration and excretion rate for calcium-loaded and non-loaded periods. (Deal-EIS)
W80-00663

UPTAKE, BINDING AND CLEARANCE OF DIVALENT CADMIUM IN GLYCERA DIBRANCHIATA (ANNELIDA: POLYCHAETA),
San Francisco Univ., CA. Dept. of Biology.
M. A. Rice, and P. K. Chien.
Marine Biology, Vol. 53, p 33-39, 1979. 6 fig, 2 tab, 26 ref.

Descriptors: *Annelids, *Cadmium, *Absorption, Path of pollutants, Heavy metals, Ions, Worms, Hydrogen ion concentration, Proteins, Chemical analysis, Animal physiology, Animal metabolism, Potassium, Tracers, Cadmium radioisotopes, *Polychaetes, *Tissue analysis, *Bioaccumulation.

The bloodworm Glycera dibranchiata accumulates cadmium through the general body surface and the intestine. Absorption through the gut accounts for cadmium which rapidly binds to coelomic proteins. Intracoelomic injection of 109 Cd demonstrates that cadmium binds readily to hemoglobin and other proteins. The degree of cadmium binding is pH-dependent. The apparent pH of binding sites in body wall and musculature homogenates is 5.39. Cadmium ions injected into the coelom at 7 microg/l tissue increase proline incorporation rates into the positively charged hemoglobin (cathode fraction) by 15-fold in 3 days. A 3-fold increase of proline incorporation was observed in the anode hemoglobin fraction over the same time period. Radioactivity in various protein fractions decreases at different rates after injection of 109 Cd. Comparisons between the function of mammalian metallothionein and the coelomic fluid proteins of G dibranchiata as a detoxification mechanism are discussed. (Deal-EIS)
W80-00664

BODY BURDEN OF CHROMIUM, COPPER, CADMIUM AND LEAD IN THE NEUSTONIC COPEPOD ANOMALOCERA PATERSONI (PONTELLIDAE) COLLECTED FROM THE MEDITERRANEAN SEA,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
G. G. Polikarpov, B. Oregioni, D. S. Parchevskaya, and G. Benayoun.
Marine Biology, Vol. 53, p 79-82, 1979. 2 fig, 5 tab, 10 ref.

Descriptors: *Copepods, *Metals, *Absorption, *Chromium, *Copper, *Cadmium, *Lead, Spectrophotometry, Chemical analysis, Animal metabolism, Animal physiology, Distribution patterns, *Tissue analysis, *Bioaccumulation.

The amounts of Cr, Cu, Cd and Pb in the copepod Anomalocera patersoni were determined for 47 individuals by flameless atomic absorption spectrophotometry. The following mean body burdens of these elements were obtained: Cr 0.6, Cu 13, Cd 0.5, Pb 1.5 nannog individual, or Cr 2.1, Cu 42, Cd 1.5 and Pb 4.8 nannog mg (dry weight). Cr, Cu and Cd contents did not differ significantly between males and females, however Pb did, with males having more. The data indicate that while the Cr, Cu and Pb body burden in these copepods follows the logarithmic normal distribution, Cd follows a normal distribution. Thus, the arithmetic means and the modes of Cd body burden are almost the same, while for the other elements the arithmetic means differ from the geometric means. This indicates that measurements of a few individuals suffice for estimating the mean body burden of Cd. On the other hand, many measurements are necessary for the body burden estimation of other elements, especially Cu. (Deal-EIS)
W80-00665

EFFECTS OF KUWAIT OILS ON FEEDING RATES OF COPEPODS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
M. F. Spooner, and C. J. Corkett.
Marine Pollution Bulletin, Vol. 10, p 197-202, 1979. 6 tab, 18 ref.

Descriptors: *Oil, *Toxicity, *Feeding rates, *Copepods, Bioassay, Kuwait oil, Animal metabolism, Animal physiology, Plankton, Oil spills, Oil pollution, Mortality, Seasonal, Methodology, *Crude oil, *Dispersants.

Sub-lethal toxicity and recovery tests were made on feeding rates of 4 species of copepods using Kuwait oils kept in suspension on a slowly rotating wheel. Counts of faecal pellets from individuals fed on standard algal suspension were made after 20 h at 12 degrees C. This exposure produced only marginal effects at 1 and 2 ppm, but 10 ppm produced definite effects on planktonic species. Recoveries were generally quite good from

'weathered' oil treatments. Oils emulsified alone did not produce significantly different effects in these experiments from oils emulsified with dispersants. (Deal-EIS)
W80-00666

MEASUREMENT OF COMPLEXING MATERIALS EXCRETED FROM ALGAE AND THEIR ABILITY TO AMELIORATE COPPER TOXICITY,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
C. M. G. Van den Berg, P. T. S. Wong, and Y. K. Chau.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 901-905, 1979. 2 fig, 3 tab, 25 ref.

Descriptors: *Copper, *Toxicity, *Aquatic algae, Phytoplankton, Ions, Metabolism, Chlorella, Scenedesmus, Anabaena, Primary productivity, Chemical reactions, Chemical properties, Tracers, Complexation, Detoxification, *Ligands.

The complexing capacities of three algal exudates and the conditional stability constants of their copper complexes have been determined by an ion exchange method. Their ability to ameliorate copper toxicity towards the primary production of Chlorella vulgaris is related to the conditional stability constants, which regulate the ionic copper concentration. Anabaena cylindrica, Navicula pelliculosa, and Scenedesmus quadricauda excreted 6.73, 2.86, and 0.66 micro mol/L of complexing ligands, respectively, with conditional stability constants of 10 to the 7.7 power, 10 to the 8.1 power, and 10 to the 8.6 power, respectively, for their corresponding copper complexes. When these constants were applied in calculations, a free copper ion concentration of 10 to the minus 10.3 power mol/L was found in each exudate. (Deal-EIS)
W80-00667

OXYGEN DEPLETION AND WINTERKILL RISK IN SMALL PRAIRIE LAKES UNDER EXTENDED ICE COVER,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
J. Barica, and J. A. Mathias.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 980-986, 1979. 7 fig, 3 tab, 12 ref.

Descriptors: *Mathematical models, *Dissolved oxygen, *Ice cover, *Iced lakes, *Winterkilling, Lakes, Eutrophication, Fishkill, Mortality, Water chemistry, Seasonal, Winter, Cold resistance, Oxygen depletion.

Mean rates of dissolved oxygen depletion in 10 shallow eutrophic prairie lakes (area 2.3-27.3 ha, mean depth 1.6-4.2 m), ranged from 0.22 to 0.34 gr/sq m/d for nonstratified lakes and 0.32-0.42 gr/sq m/d for stratified ones. An average rate for all lakes was 0.29 plus or minus 0.06 gr/sq m/d. The rates correlated with the lake depth. A method for estimating the winterkill risk on the basis of initial oxygen storage, rate of dissolved oxygen depletion and/or the mean or maximum lake depth is proposed. (Deal-EIS)
W80-00668

ZINC UPTAKE IN MARINE DIATOMS,
Tokyo Univ. of Fisheries (Japan).
A. Kamatani, M. Takahashi, and Y. Morita.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 6, p 715-719, 1979. 3 fig, 4 tab, 23 ref.

Descriptors: *Zinc, *Absorption, *Diatoms, Toxicity, Phosphates, Phosphorus, Chelation, Heavy metals, Primary productivity, Water chemistry, Chemical analysis, Growth rates, *Bioaccumulation.

Three diatoms, Cyclotella nana, Phaeoductylum tricornutum and Thalassiosira decipiens, were used for estimating the requirement and the toxicity of zinc. For their normal growth the diatoms required zinc at the level of 0.1 microg/l. Thus, the zinc levels in the seawater do not constitute a limiting factor for maintaining the potential primary production level resulting from the estimation with the oceanic phosphate-phosphorus. The zinc toxicity at high concentration was suppressed by the presence of chelator (EDTA). In the case of experiments with EDTA the amount of zinc taken up by diatoms was found to be independent of the ambient zinc concentration, while without EDTA the uptake of zinc varied depending upon the concentration. The minimum requirement of zinc for normal growth per unit-weight of diatom was estimated as 1-3 ppm, and the diatoms, which were harvested from the culture medium with EDTA, accumulated more zinc in their body, by one order of magnitude, than their minimum requirement. (Deal-EIS)
W80-00669

MUTAGENIC ACTIVITY IN ORGANIC WASTEWATER CONCENTRATES,
California Univ., Berkeley. School of Public Health.
S. M. Rappaport, M. G. Richard, M. C. Hollstein, and R. E. Talcott.
Environmental Science and Technology, Vol. 13, No. 8, p 957-961, 1979. 1 fig, 3 tab, 36 ref.

Descriptors: *Bioassay, *Laboratory tests, *Monitoring, *Waste treatment, Methodology, Organic wastes, Pulp and paper industry, Waste disposal, Waste treatment, Waste water disposal, Testing, Testing procedures, Primary waste treatment, Secondary waste treatment, Relative toxicity, *Mutagenicity.

Organic wastewater concentrates from six treatment plants were tested for mutagenicity using the Ames mutagen bioassay. Concentrates were prepared by passing 4-8 L of wastewater through two porous copolymer resins (Amberlite XAD-2 and XAD-7) in series. Of four tester strains, TA-98 in the presence of Arochlor-induced rat liver enzymes was the most sensitive indicator of mutagenicity. Mutagenic responses were observed in extracts from most of the plants tested. More activity was found in secondary and post-secondary extracts than in primary extracts. Dose-response curves obtained for selected samples showed a maximum activity of 210 revertants/mg of extract (TA-98 plus S-9). Fractionation of positive extracts showed the activity to be primarily in the basic and neutral fractions, while acid fractions were relatively inactive. Waste waters treated were domestic, industrial, electronic, cannery and agricultural wastes. (Katz-EIS)
W80-00670

MIXING AN ENCLOSED, 1300 CUBIC METER WATER COLUMN: EFFECTS ON THE PLANKTONIC FOOD WEB,
British Columbia Univ., Vancouver. Inst. of Oceanography.
N. C. Sonntag, and T. R. Parsons.
Journal of Plankton Research, Vol. 1, No. 1, p 85-102, 1979. 5 fig, 5 tab, 25 ref.

Descriptors: *Food webs, *Plankton, *Nutrients, Phytoplankton, Zooplankton, Chum salmon, Copepods, Growth rates, Productivity, Trophic level, Bottom sediments, Mortality, Fish food organisms, *Ctenophores.

The nutrient, phytoplankton, and zooplankton dynamics in three enclosed water columns (1300 cubic meter) are described. Two of the enclosures were mixed using a bubbling chamber at depth. Young chum salmon (Oncorhynchus keta) were added to one of the mixed enclosures and the unmixed enclosure. No other manipulations were imposed. Copepods appeared in large numbers (e.g. especially Pseudocalanus minutus s.l. and Paracalanus parvus) and population growth rates were estimated. Ctenophores did not appear in large numbers despite presumably ideal food environments; it is suggested that in one enclosure this is a consequence of fish predation on the ctenophores. The fish experienced high mortalities and low growth rates presumably due to unsuitable prey size. Weekly collections of sediment permitted isolation of two major sediment contributors, the first from phytoplankton sinking and the second from biogenic fallout associated with herbivore production. It was found that the more oligotrophic enclosure (unmixed) experienced proportionally higher utilization of organic carbon. Some of these results are explained by our data while others require more sophisticated experimentation, both in the design of the containers and in the types of observations. (Deal-EIS)
W80-00672

TOXICITY AND PHARMACOLOGY OF EXTRACTS FROM DORID NUDIBRANCHS,
Stanford Univ., Pacific Grove, CA. Hopkins Marine Station.
F. A. Fuhrman, G. J. Fuhrman, and K. DeRiemer.
Biological Bulletin, Vol. 156, p 289-299, 1979. 1 tab, 3 fig, 40 ref.

Descriptors: *Mollusks, *Nudibranchs, *Toxins, *Mode of action, Chemical analysis, Doriopsilla, Anisodoris, Histamine, Invertebrates, Pharmacology, Analytical techniques, Methodology, Chemical properties.

Dorid nudibranch mollusks rely on a variety of mechanisms to rend themselves undesirable to predators. Toxic substances have been isolated and identified in some species collected from around California. Aqueous extracts of digestive glands of five species of dorid nudibranchs were lethal when injected into shore crabs and when injected intrperitoneally into mice. Though histamine was identified in the extract, the amount present was too small to account for the toxicity of the glands. An active fragment designated 'dorid toxin' was obtained by fractionation. This substance produced lethargy and bradycardia in mice. It has negative inotropic and chronotropic effects on isolated hearts. It is heat stable and resistant to profeases so it is probably not a polypeptide. (D. Katz-EIS)
W80-00673

NEPHROCALCINOSIS IN RAINBOW TROUT SALMO GAIRDNERI RICHARDSON; THE EFFECT OF EXPOSURE TO ELEVATED CO2 CONCENTRATIONS,
Shearwater Fish Farming Carlisle (England).
G. R. Smart, D. Knox, J. G. Harrison, J. A. Ralph, and R. H. Richards.
Journal of Fish Diseases, Vol. 2, p 279-289, 1979. 1 fig, 6 tab, 20 ref.

Descriptors: *Fish diseases, *Rainbow trout, *Carbon dioxide, Bioassay, Animal pathology, Chemical analysis, Fish physiology, Phosphates, Fish diets, Water chemistry, Calcium, Magnesium, Phosphorus, *Tissue analysis, *Kidney.

Rainbow trout exposed to environmental free CO2 concentrations ranging from 12-60 mg/l for a minimum of 275 days developed nephrocalcinosis. Gross histopathological and chemical examinations demonstrated that prevalence and severity of nephrocalcinosis increased with increasing CO2 concentrations. The condition was characterized by calcification and granuloma formation in kidney and stomach. Diet, but not water, PO4-P concentration appeared to modify the prevalence and severity at each CO2 concentration tested. (Deal-EIS)
W80-00674

THE EFFECT OF CADMIUM AND LEAD ON THE GROWTH OF TWO SPECIES OF MARINE PHYTOPLANKTON WITH PARTICULAR REFERENCE TO THE DEVELOPMENT OF TOLERANCE,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
J. R. Jennings.
Journal of Plankton Research, Vol. 1, No. 2, p 121-136, 1979. 6 fig, 2 tab, 37 ref.

Descriptors: *Cadmium, *Lead, *Growth rates, *Toxicity, *Phytoplankton, Bioassay, Salinity, Resistance, Mortality, Heavy metals, Chlorophyta, Chrysophyta, Water chemistry, Marine algae.

Decreases in salinity (<10%) increased the growth rates of Phaeodactylum tricornutum and Dunaliella tertiolecta. Increasing levels of cadmium (1-50 ppm(mg/l)) reduced the growth rates of both species. 100 ppm cadmium was lethal to D. tertiolecta but not to P. tricornutum. Lead (1-4 ppm) initially increased the growth rate of D. tertiolecta but then caused all but the 1 ppm culture to die. Lead (1-4 ppm) caused a decrease in growth rate of P. tricornutum. After exposure to 1 ppm cadmium, cultures of D. tertiolecta showed an increased tolerance to levels of cadmium, and a changed response to levels of lead. Exposure of P. tricornutum to either cadmium or lead, or exposure of D. tertiolecta to lead caused no change in response to either metal. (Deal-EIS)
W80-00676

REDUCTION OF NONIONIC SURFACTANT TOXICITY BY SECONDARY TREATMENT,
Procter and Gamble Co., Cincinnati, OH.
A. W. Maki, A. J. Rubin, R. M. Sykes, and R. L. Shank.
Journal of the Water Pollution Control Federation, Vol. 51, No. 9, p 2301-2313, 1979. 3 fig, 5 tab, 20 ref.

Descriptors: *Surfactants, *Toxicity, *Secondary treatment, Detergents, Biodegradation, Wastewater treatment, Minnows, Water chemistry, Benthic fauna, Activated sludge, Sewage effluents, Sunfishes, Daphnia, Biochemical oxygen demand, Alkyl ethoxylate surfactant.

Field and laboratory studies of biodegradability and toxicity of an alkyl ethoxylate nonionic surfactant were conducted to determine degradability of the surfactant by secondary wastewater treatment and the effects of the effluent on the benthic fauna of the receiving stream. No increase in surfactant levels in plant effluent or stream stations was observed during periods when influent was spiked at 4 and 14 mg/l. The acute toxicity is eliminated by secondary treatment and the degradation products of an initial 30 mg/l concentration are nontoxic to fathead minnows. Significant changes in benthic species composition and density of some macroinvertebrates occurred during the spiking program, but these resulted from the natural seasonal life cycles. (Deal-EIS)
W80-00678

ACUTE TOXICITY OF COPPER, CADMIUM AND ZINC TO THREE SPECIES OF MARINE COPEPOD,
Victoria Ministry for Conservation, Melbourne (Australia). Marine Pollution Studies Group.
G. H. Arnott, and M. Ahsanullah.
Australian Journal of Marine and Freshwater Research, Vol. 30, p 63-71, 1979. 2 tab, 34 ref.

Descriptors: *Lethal limit, *Toxicity, *Copper, *Cadmium, *Zinc, *Copepods, *Methodology, Laboratory tests, Metals, Crustaceans, Laboratory tests, Path of pollutants, Scutellidium, Paracalanus, Acartia, Invertebrates, Plankton, Aquatic animals, Bioindicators.

Acute toxicity tests were carried out with three metals on the marine copepods Scutellidum sp., Paracalanus parvus and Acartia simplex. The resulting 24-h LC50 values showed that copper was the most toxic metal, with cadmium more toxic than zinc for two of the three species. Scutellidium sp. was more sensitive than P. parvus and A. simplex to all metals, LC50 values being 0.18, 0.66 and 1.09 mg/l for copper, cadmium and zinc respective other marine copepods given by other workers. Some experimental problems in conducting toxicity tests with copepods are indicated. Application of the present LC50 data to existing water quality criteria produced unrealistic 'safe' concentrations in the case of copper. Such a finding illustrates the arbitrary nature of application factors and questions the usefulness of acute toxicity tests as the major tool for environmental protection. (D. Katz-EIS)
W80-00679

SURVEY OF DEMERSAL FISH IN PORT PHILLIP BAY FOR INCIDENCE OF NEOPLASIA,
Melbourne Univ. Medical Centre. Parkville (Australia).
G. C. Hard, R. Williams, and J. Lee.
Australian Journal of Marine and Freshwater Research, Vol. 30, p 73-79, 1979. 5 fig, 21 ref.

Descriptors: *Neoplasms, *Fish Diseases, *Pathology, *Demersal fish, *Marine fish, Water pollution effects, Port Phillip Bay(Australia), Industrial wastes, Domestic wastes, Rhombosolea, Ammotrehs, Platycephalus, Atopomycterus, Sphaeroides, Navodon, Scobinichthys, Brachaluteres, Paratrigla, Benthic fauna, Flounders, Benthos, Microscopy, On-site investigations.

A survey aimed at determining the incidence of neoplasms, particularly superficial tumours, in the common demersal fish species in zones of Port Phillip bay exposed to domestic and industrial contamination has been conducted on a monthly basis over a period of 17 months. Trawling at three sampling stations provided sufficient numbers for scrutiny of a range of species. In contrast with the experience overseas of epidermal papillomas in certain species of pleuronectids, the Port Phillip Bay flounder were totally free of skin tumours. Only two true neoplasms were encountered, a neurilemmoma and a lipoma, both of these being from specimens of Platycephalus bassensis. A high incidence of non-neoplastic skin 'tumours' was observed in certain letherjackets (family Balistidae). The essentially negative findings in terms of cancer incidence provides a reference base for any future studies examining disease patterns in faunal populations of Port Phillip Bay. (D. Katz-EIS)
W80-00680

THE ROLE OF MELANO-MACROPHAGE CENTRES IN IRON STORAGE IN NORMAL AND DISEASED FISH,
Stirling Univ. (Scotland). Unit of Aquatic Pathobiology.
C. Agius.
Journal of Fish Diseases, Vol. 2, p 337-343, 1979. 1 fig, 2 tab, 10 ref.

Descriptors: *Fish diseases, *Fish physiology, *Iron, Teleosts, Chemical analysis, Animal metabolism, Proteins, Rainbow trout, Animal pathology, Fish diets, Path of pollutants, Fresh water fish, *Tissue analysis, *Liver, *Spleen, *Kidney.

The spleen, kidney and liver melano-macrophage centres of 14 species of clinically normal teleost fish were examined histochemically for ferric iron. Iron was present in varying amounts within the splenic centres of most specimens, but by contrast it was rarely found in the centres of the kidney and the liver. Under conditions of starvation and in diseased fish, a markedly increased deposition of ferric iron occurred in the splenic centres of nearly all fish examined. By comparison, the iron content in the kidney and liver centres was generally still very low. These results suggest that there exist important functional differences between the pigment centres of different haemopoietic tissues of teleosts. (Deal-EIS)
W80-00683

EFFECTS OF ACID MINE DRAINAGE ON A SOUTHWESTERN PENNSYLVANIA STREAM,
California State Coll., PA. Dept. of Biology.
T. C. Moon, and C. M. Lucostic.
Water, Air and Soil Pollution, Vol. 11, p 377-390, 1979. 10 fig, 1 tab, 41 ref.

Descriptors: *Acid streams, *Mine drainage, *Coal mine wastes, Acidic water, Acid mine water, Mine wastes, Pennsylvania, Coals, Benthic fauna, Invertebrates, Water chemistry, Diptera, Aquatic insects, Dominant organisms, Ecological distribution, *Species diversity.

Physicochemical parameters and benthic macroinvertebrate community structure were studied in a small valley stream in southwestern Pennsylvania. Sampling stations were located upstream and downstream of coal mine drainage input. Due to an alkaline discharge and significant downstream alkalinity the pH below the mine effluent remained between 5.8 and 7.0 throughout the course of this 18 mo. study. The major factor affecting the benthic community seemed to be ferric hydroxide deposition. Certain taxa (Plecoptera and Ephemeroptera) were abundant at station sites above the mine discharge, while only those taxa tolerant of polluted conditions, such as Chironomidae and Tubifex, were prevalent at the downstream station sites. An analysis of benthic populations through changes in total numbers, species diversity, and species indicator organisms graphically demonstrated environmental stress within this aquatic ecosystem. (Deal-EIS)
W80-00684

STUDY OF METAL CONTENTS OF ELASMOBRANCH FISHES: PART I-METAL CONCENTRATION IN THE MUSCLE TISSUES OF A DOGFISH, SQUALUS MITSUKURII,
Tokyo Univ. (Japan). Dept. of Agricultural Chemistry
M. Taguchi, K. Yasuda, S. Toda, and M. Shimizu
Marine Environmental Research, Vol. 2, p 239-249, 1979. 4 tab, 4 fig, 21 ref.

Descriptors: *Heavy metals, *Mercury, *Cadmium, *Bioaccumulation, *Sharks, Path of pollutants, Length, Elasmobranchs, Tissue analysis, Metals, Zinc, Iron, Copper, Squalus, Analytical techniques, Dogfish, Marine fish, Embryonic growth stage, Food chains, Trophic levels, Distribution patterns.

Concentrations of Hg, Zn, Fe, Cd and Cu in the muscle tissues of a dogfish, Squalus mitsukurii, were determined by atomic absorption spectrometry and found to be in the ranges of 0.019-2.13, 1.8-3.6, 1.5-5.7, 0.001-0.018 and 0.12-0.70 microgr/gr wet weight, respectively. The frequency distributions of concentrations, with the exception of mercury, were found to be log-normal. The correlation coefficient between mercury content and total length was positive and large and statistically highly significant. For other metals negative correlations were observed. Mercury concentration in the muscle was found to increase in proportion to the total length cubed. Regression of mercury concentration on age of sharks was shown to be linear. Analysis of covariance showed that the difference between sexes was not statistically significant, either in slope or in height. The concentration of mercury in the muscle tissues of embryos was considerably lower, Cd roughly the same and Zn and Fe higher than those of mothers. The concentrations of Zn, Fe and Cu are higher in the embryonic stage and immediately after birth than in later stages of growth. (D. Katz-EIS)
W80-00685

CONCENTRATION AND SOURCES OF FECAL AND ORGANIC POLLUTION IN AN AGRICULTURAL WATERSHED,
Allen County Soil and Water Conservation District, Fort Wayne, IN.
D. R. Dudley, and J. R. Karr.
Water Resources Bulletin, Vol. 15, No. 4, p 911-923, 1979. 2 fig, 6 tab, 17 ref.

Descriptors: *Organic wastes, *Coliforms, *Agricultural wastes, Sewage bacteria, Indiana, Agricultural runoff, Discharge(Water), Biochemical oxygen demand, Public health, Water quality standards, Farm wastes, Septic tanks, Pathogenic bacteria, Streptococcus, Livestock operations.

Fecal contamination and organic pollution of an agricultural drainage in northeast Indiana was high. Bacterial counts (total coliform, TC; fecal coliform, FC; and fecal streptococcus, FS) and biochemical oxygen demand (BOD) were used to assess waste concentrations. Coliform counts indicated that sections of the drainage receiving septic effluent had waste concentrations far in excess of public health standards. Areas of drainage remote from septic tank pollution were found to occasionally meet federal public health standards for whole body contact recreation but generally these areas had twice the allowable limit of 200 FC/100 ml. Bacterial contamination was highest during runoff

events when the median values for TC, FC, and FS were 5, 3, and 17 times greater, respectively, than the median values during low stream discharge. Surface flows carried contaminants from unconfined livestock operations and fecally contaminated sediment was transported by high waters. (Deal-EIS)
W80-00687

SOME OBSERVATIONS ON POLLUTANTS OF VELSAO BAY (GOA),
National Inst. of Oceanography, Goa (India).
M. D. Zingde, S. Y. S. Singbal, and C. V. G. Reddy.
Mahasagar-Bulletin of the National Institute of Oceanography, Vol. 12, No. 2, p 69-74, 1979. 1 fig, 4 tab, 12 ref.

Descriptors: *Fishkill, *Industrial wastes, *Copper, *Zinc, *Manganese, *Iron, *Nickel, Lead, Metals, Fertilizers, Fish physiology, Toxicity, Mortality, Water quality, Ammonia, Nitrates, Nitrites, Phosphates, Water chemistry, *Arsenic, *Tissue analysis.

Results have been reported on As, Cu and Zn in some of the dead fishes collected during the fishkill at Velsao Bay where the effluents from a fertilizer factory were being discharged. The levels were compared with those from unpolluted localities. While the levels of copper and zinc are comparable, arsenic was higher in dead fishes. The observed concentrations, however, do not indicate acute toxicity. The environmental parameters indicate significant changes in the water quality of the Velsao Bay. Trace metals in the oysters of the Velsao Bay were monitored and the observed concentrations of Mn, Fe, Ni, Cu, Zn, As and Pb do not indicate any significant influence of the factory effluents. (Deal-EIS)
W80-00688

SIMULATION MODEL OF THE EVOLUTION OF THE CHEMICAL COMPOSITION OF A MINERAL-SOLUTION SYSTEM AND ITS APPLICATIONS (MODELE DE SIMULATION DE L'EVOLUTION DE LA COMPOSITION CHIMIQUE D'UN SYSTEME MINERAUX-SOLUTION ET SES APPLICATIONS),
Groupement d'Etudes et de Realisations des Societes d'Amenagement Regional, Nimes (France).
M. Dosso, and A. Carriere.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 237-242, 1978. 3 fig.

Descriptors: *Model studies, *Saline soils, *Water quality, *Soil water movement, Mathematical models, Evaporation, Sodium, Calcium, Magnesium, Analytical techniques, Chemical properties, Water properties, Mineral water, Salts, Aqueous solutions, Saturation, Ions, Chemical reactions, Ionization, Adsorption, Sodium adsorption ratio.

The model presented in this paper was based on the thermodynamic relationships which characterize the equilibrium relationships between minerals and solutions. It calculated from the composition of a given water, the distribution of simple and complex ions and the degree of saturation of the solution in relation to a large number of minerals and salts. It simulated the dissolution reactions of one or several minerals as well as the evaporation of the solution. The main application was the construction of a model simulation of saline soils or soils susceptible to becoming saline. (See also W79-00379) (Humphreys-ISWS)
W80-00721

PETROLEUM HYDROCARBONS IN URBAN RUNOFF,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 5B.
W80-00730

A MORPHOMETRIC STUDY OF LEAD AND COPPER EFFECTS ON DIATOMA TENUE VAR. ELONGATUM (BACILLARIOPHYTA),
Michigan Univ., Ann Arbor. Great Lakes Research Div.
L. Sicko-Goad, and E. F. Stoermer.
Journal of Phycology, Vol. 15, p 316-321, 1979. 5 fig, 2 tab, 35 ref.

Descriptors: *Lead, *Copper, *Growth rates, *Toxicity, Diatoms, Phosphorus, Cytological studies, Nutrients, Phosphates, Chemical analysis, Electron microscopy, Heavy metals, Path of pollutants, Metabolism.

Polyphosphate bodies containing lead were induced in laboratory cultures of Diatoma tenue var. elongatum Lyngb. by the addition of phosphorus and 0.05 microg-atoms/1 Pb to P deficient medium. Morphometric analysis of cells exposed to Pb showed a significant decrease in number of mitochondria with a concomitant increase in their volume and an increase in membranous organelles in the vacuole compared to phosphorus starved and phosphorus sufficient controls. Exposure of cultures to 0.08 microg-atoms/1 copper resulted in reduction of the number of polyphosphate bodies formed during luxury uptake but no other significant morphological changes in cellular organelles. Ecological implications of the interactions between nutrients and low level trace metal contamination are discussed. (Deal-EIS)
W80-00782

TEMPERATURE-MONITORING AND SAFETY-CONTROL DEVICE,
Environmental Research Lab.-Duluth, MN.
A. E. Lemke, and W. F. Dawson.
The Progressive Fish Culturist, Vol. 41, No. 3, p 165-166, 1979. 2 fig, 1 tab, 1 ref.

Descriptors: *Research equipment, *Water temperature, *Monitoring, Bioassay, Equipment, Aquaria, Electrical equipment, Automation, Electric switches, Aquiculture, Laboratory equipment.

Experimental work involving poikilothermic animals such as fish and aquatic invertebrates requires close control of temperature. This report describes a solid-state monitoring apparatus that has a variable set point and variable diversion from set point as well as an output to a single alarm system for alerting personnel when diversion occurs. The set point can be varied continuously from 0 to 50 C, and the diversion can be varied from 0.3 to 2.0 C. (Deal-EIS)
W80-00783

COMPARISON OF ANESTHETIC POTENCY OF BENZOCAINE HYDROCHLORIDE AND MS-222 IN TWO FRESHWATER FISH SPECIES,
Randse Afrikaanse Univ., Johannesburg (South Africa). Dept. of Zoology.
J. T. Ferreira, G. L. Smit, H. J. Schoonbee, and C. W. Holzapfel.
The Progressive Fish Culturist, Vol. 21, No. 3, p 161-163, 1979. 1 fig, 1 tab, 8 ref.

Descriptors: *Chemical properties, *Carp, *Tilapia, *Aquiculture, Fish physiology, Freshwater fish, Chemical analysis, Organic compounds, Animal metabolism, Fish management, Analytical techniques, Toxicity, *Anesthetics, *MS-222, *Benzocaine hydrochloride.

The hydrochloride of ethyl p-aminobenzoate was synthesized and its anesthetic potency compared with that of MS-222 at concentrations of 50, 80, and 100 mg/L. The free compound of these agents in fish blood was also determined. The results indicate that benzocaine hydrochloride is a more effective anesthetic than MS-222 at the concentrations applied. It must be pointed out, however, that benzocaine hydrochloride is not registered for fishery use in the United States. (Deal-EIS)
W80-00784

TOXICITY OF FISHERY CHEMICALS TO THE ASIATIC CLAM, CORBICULA MANILENSIS,
Fish and Wildlife Service, Warm Springs, GA. Southeastern Fish Control.
J. H. Chandler, Jr., and L. L. Marking.
The Progressive Fish Culturist, Vol. 41, No. 3, p 148-151, 1979. 2 tab, 12 ref.

Descriptors: *Pesticide toxicity, *Clams, *Pesticides, Fish control agents, Animal physiology, Fouling, Chemical properties, Rotenone, Animal control, *Lampricides, *Disinfectants, *Antimycin, *TFM, *Bayer 73.

The Asiatic clam, a species introduced into U.S. waters, has spread rapidly, and its ability to survive, reproduce, and spread has caused concern. Aquatic biologists suspect that the clams may crowd out indigenous mollusks, and the animals sometimes plug water intake and leave shell deposits that interfere with sand and gravel operations. The toxicity of 20 commonly used fishery chemicals to the Asiatic clam was determined to evaluate hazards to a nontarget aquatic invertebrate and to assess the potential of the chemicals for controlling clam populations. Among six pesticides and two lampricides tested, antimycin was most toxic to the clam; the 96-H LC50 was 0.065 mg/L. Among three therapeutants and two disinfectants tested, nifurpirinol was the most toxic; the 96-h LC50 was 7.60 mg/L. All of the compounds were less toxic to the clam than to fish. As a nontarget organism, this clam would be safe in water treated with any of the tested fishery chemicals at recommended use pattern concentrations. None of the chemicals have potential for controlling unwanted populations of these clams. (Deal-EIS)
W80-00785

CARBONIC ACID ANESTHESIA FOR AQUATIC ORGANISMS,
Colorado State Univ., Fort Collins. Dept. of Fishery and Wildlife Biology.
G. Post.
The Progressive Fish Culturist, vol. 21, No. 3, p 142-144, 1979. 2 fig, 9 ref.

Descriptors: *Fish physiology, *Chemical properties, *Acids, Fish management, Toxicity, Enzymes, Inhibition, Animal metabolism, Fish behavior, Sulfuric acid, Chemical reactions, *Anesthetics, *Carbonic acid.

Carbonic acid in water is a safe, inexpensive, effective, convenient, and easily obtainable anesthetic for fish and other aquatic organisms. Carbonic acid is not a controlled substance in the United States, and may not require U.S. Food and Drug Administration registration. Baths containing 150 to 600 mg/L carbonic acid (H_2CO_3) will anesthetize fish; lower concentrations anesthetize more slowly and less deeply, higher concentrations act more rapidly and with greater sedation. The length of time that fish or aquatic organisms can safely be held in anesthetizing baths depends on the carbonic acid concentration, and is longer at low concentrations than at high concentrations. A convenient procedure for developing known concentrations of carbonic acid in anesthetizing baths involves adding equal volumes of 6.75% (wt/vol) sodium bicarbonate solution and 3.95% (wt/vol) of concentrated (97-98%) sulfuric acid solution to a known volume of water. (Deal-EIS)
W80-00786

MODIFIED VENTURE SUCTION SAMPLER FOR COLLECTING ASIATIC CLAMS,
Oak Ridge National Lab., TN.
J. S. Mattice, and W. Bosworth.
The Progressive Fish Culturist, Vol. 41, No. 3, p 121-123, 1979. 2 fig, 17 ref.

Descriptors: *Research equipment, *Sampling, *Clams, Methodology, On-site data collections, Benthic fauna, Equipment, Pumps, Bottom sampling, Data collections, Asiatic clam.

A device for collecting quantitative samples of the Asiatic clam, Corbicula sp., is described. The sampler is a modified venturi that is normally operated by a diver using scuba. Constriction of the water flow in the sampler supplies a pressure differential, causing water to be sucked in through a side arm.

Water to operate the venturi is supplied by a gasoline-powered pump on a boat, and is conducted to the sampler by a flexible fire hose 7.6 cm (3 in.) in diameter. The sampler is constructed of polyvinylchloride. Suction lifts the substrate and associated clams from a sampling frame placed on the bottom and the main water stream carries the clams through a discharge arm to a mesh collection bag. The sampler is efficient in gravel or rocky substrates, is not depth-limited, is inexpensive and easy to construct, and permits collection of large samples (0.25 sq m). Its use permits the accurate density estimates required for population and community studies. (Deal-EIS)
W80-00787

BIOGEOCHEMISTRY OF SELECTED HEAVY METALS IN WESTERN PORT, VICTORIA, AND USE OF INVERTEBRATES AS INDICATORS WITH EMPHASIS ON MYTILUS EDULIS PLANULATUS,
Victoria Ministry for Conservation, Melbourne (Australia).
J. E. Harris, G. J. Fabris, P. J. Statham, and F. Tawfik.
Australian Journal of Marine and Freshwater Research, Vol. 30, p 159-178, 1979. 4 fig, 7 tab, 36 ref.

Descriptors: *Mussels, *Heavy metals, *Bioindicators, Monitoring, *Cadmium, *Copper, *Iron, *Manganese, *Lead, *Zinc, Sediments, Invertebrates, Geochemistry, Chemical analysis, Industrial wastes, Water chemistry, Swamps, Absorption, *Tissue analysis, Australia, Western Port.

The relationships of Cd, Cu, Fe, Mn, Pb and Zn in sediments, seagrasses, and several invertebrates with geological source areas in the Western Port catchment are examined. Highest concentrations of heavy metals in sediments and seagrasses appear to be derived from an old swamp environment. Highest levels of Cd, Fe, and Pb are found in mussels on the eastern side of the embayment where suspended sediment and detritus from seagrass meadows of the Embayment Head would be carried by the clockwise net circulation in the bay. Zinc distributions are affected by an industrial discharge which has been studied using mussels transplanted from an uncontaminated location. Possible loss of iron and lead from tissues of M. edulis planulatus during freeze-drying was noted and the concentrations of Cd, Cu, Mn, Zn and water content were found to be linear functions of mussel length. The highest levels of cadmium in M. edulis planulatus are found along the non-industrialized eastern side of the embayment. Problems in comparing heavy metal levels in mussels from different areas are discussed. (Deal-EIS)
W80-00788

UPTAKE OF CADMIUM BY THE EELGRASS ZOSTERA MARINA,
Adelphi Univ., Garden City, NY. Dept. of Biology.
W. E. Faraday, and A. C. Churchill.
Marine Biology, Vol. 53, p 293-298, 1979. 2 fig, 1 tab, 25 ref.

Descriptors: *Cadmium, *Absorption, *Plant physiology, Rhizomes, Root systems, Heavy metals, Path of pollutants, Chemical analysis, Aquatic plants, Sediments, *Eelgrass, *Zostera, *Bioaccumulation, *Tissue analysis.

The uptake of cadmium by the shoots of Zostera marina L. (eelgrass) was examined in the laboratory. Experiments were carried out in experimental chambers which allowed the separation of the leaves from the root-rhizome portions of intact shoots. Cadmium uptake by the root-rhizome portions over 24 h was directly related to substrate cadmium concentration (1.0, 5.0 and 10.0 micrograms Cd/ml) and varied from 6.5 to 30.0 micrograms Cd/ml. Cadmium uptake by the root-rhizomes and the leaves in a substrate concentration of 1 micrograms Cd/ml was also related to exposure times (24, 48 and 72 h). Maximum uptake by the root-rhizomes and the leaves was observed after 72 h at a substrate concentration of 1 micrograms Cd/ml and was equivalent to 48 and 94 micrograms Cd/ml, respectively. Translocation of cadmium from the leaves to the root-rhizomes was observed after 24 h, and at the end of 72 h was equivalent to 27% of the total leaf uptake. No cadmium movement from the root-rhizomes to the leaves was detected. (Deal-EIS)
W80-00789

INTERACTIVE EFFECTS OF SALINITY, TEMPERATURE AND POLYCYCLIC AROMATIC HYDROCARBONS ON THE SURVIVAL AND DEVELOPMENT RATE OF LARVAE OF THE MUD CRAB RHITHROPANOPEUS HARRISII,
Texas A and M Univ., College Station. Dept. of Biology.
R. B. Laughlin, Jr., and J. M. Neff.
Marine Biology, Vol. 53, p 281-291, 1979. 8 fig, 6 tab, 44 ref.

Descriptors: *Growth rates, *Crabs, *Aromatic compounds, *Toxicity, Oil, Oil spills, Animal physiology, Growth stages, Salinity, Water temperature, Mortality, Larval growth stage, Bioassay, *Naphthalene, *Metamorphosis, Polyaromatic hydrocarbons, Phenanthrene.

Zoeae of the mud crab Rhithropanopeus harrisii (Gould) were exposed continuously throughout larval development to factorial combinations of salinity, temperature and specific aromatic hydrocarbon concentrations. Salinities and temperatures were 5, 15, or 25 ppt and 20, 25, or 30C, respectively. Either phenanthrene or naphthalene was tested separately at respective concentrations of 0, 100, 150 or 200 ppb and 0, 125, 250 or 500 ppb. Phenanthrene was much more toxic than naphthalene. Naphthalene was not acutely toxic at any physical factor combination-naphthalene concentration tested. Both compounds caused the highest mortality at low salinities. The time course of mortality due to phenanthrene exposure showed that ecdysis between the first and second zoel stage was the most sensitive period for the larvae exposed to aqueous hydrocarbons. Phenanthrene-exposed larvae had a decreased development rate, but the naphthalene-exposed larvae developed faster than the controls. (Deal-EIS)
W80-00790

THE ROCK OYSTER SACCOSTREA GLOMERATA AS AN INDICATOR OF TRACE METALS IN HONG KONG,
Fisheries Research Station, Aberdeen (Hong Kong).
D. J. H. Phillips.
Marine Biology, Vol. 53, p 353-360, 1979. 2 fig, 4 tab, 27 ref.

Descriptors: *Bioindicators, *Oysters, *Trace elements, Metals, Heavy metals, *Cadmium, *Copper, *Iron, *Zinc, Chemical analysis, Monitoring, Water quality, Industrial wastes, Chemical wastes, Domestic wastes, Animal metabolism, *Tissue analysis, *Bioaccumulation.

An urgent need for a sub-tropical and tropical indicator organism for use in the biological monitoring of pollutants is recognised. To this end, preliminary studies have been undertaken to test the indicator ability of the rock oyster for monitoring the trace metals cadmium, copper, iron and zinc. A survey of these trace metals in rock oysters from 54 sites in Hong Kong waters revealed elevated levels of metals in several areas. Profiles of metal abundance in S. glomerata agreed substantially with the distribution of industrial and domestic discharges in Hong Kong, and also with patterns of contamination found in studies of the Pacific oyster Crassostrea gigas and of sediments. Application of statistical analysis to these data has confirmed the relationship between known areas of contamination and elevated metal levels in S. glomerata. This oyster, which exhibits an unusually great capacity to accumulate a range of elements from the ambient environment, thus appears to be a reliable indicator organism, and may be of great value in global monitoring studies. (Deal-EIS)
W80-00793

THE USE OF CHIRONOMID PUPAL EXUVIAE IN THE SURVEILLANCE OF SEWAGE POLLUTION WITHIN A DRAINAGE SYSTEM,
Bristol Univ. (England). Dept. of Zoology.
J. D. McGill, R. S. Wilson, and A. M. Brake.
Water Research, Vol. 13, p 887-894, 1979. 7 fig, 2 tab, 22 ref.

Descriptors: *Sewage effluents, *Toxicity, *Diptera, *Bioindicators, Dominant organisms, Monitoring, Growth stages, Sewage treatment, Biochemical, Oxygen demand, Suspended solids, Ammonia, Water quality, Water chemistry, Aquatic insects, Seasonal.

Collections of chironomid pupal exuviae were made during the summers of 1976 and 1977 above and below a number of sewage effluent discharges in the Bristol R. Avon drainage system. It was found that the exuvial collections showed changes in their species composition and relative species abundance which matched the overall polluting effects of the various discharges, the most change occurring below effluents of poor quality discharging into small rivers. The pollutional effects were more marked during 1976 when the rivers had unusually low flow, than in 1977 when the river flows were higher. It is concluded that biological changes consequent on sewage effluent discharge into these rivers can be monitored by sampling the chironomid pupal exuviae above and below the site of discharge. (Deal-EIS)
W80-00794

CHRONIC TOXICITY OF VANADIUM TO FLAGFISH,
Guelph Univ. (Ontario). Dept. of Zoology.
D. A. Holdway, and J. B. Sprague.
Water Research, Vol. 13, p 905-910, 1979. 3 tab, 19 ref.

Descriptors: *Toxicity, *Metals, Bioassay, Mortality, Growth rates, Larval growth stage, Fish reproduction, Fish physiology, Fry, Chemical analysis, Fecundity, *Flagfish, *Jordanella, *Vanadium, *Bioaccumulation, *Tissue analysis.

The 96-h LC50 of vanadium to adult American flagfish (Jordanella floridae) was 11.2 mg/l in very hard water. Larvae showed 28-day LC50's of 1.13 and 1.88 mg/l of vanadium with larger larvae being more resistant. These appeared to be thresholds of lethality. During continuous exposure for 96 days, larval growth and survival were the most sensitive indicators of vanadium toxicity and were marginally reduced at 0.17 mg/l. At 0.041 mg/l, there were no deleterious sublethal effects but there was definite stimulation of growth in females and of reproductive performance. The threshold for chronic toxicity was judged to be about 0.08 mg/l. The 'safe'-to-lethal ratio was 0.007 and this could be used as an application factor for other species. There was no clear evidence that vanadium had any long-term cumulative toxicity. (Deal-EIS)
W80-00795

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
F. L. Petrilli, G. P. De Renzi, R. P. Morelli, and S. De Flora.
Water Research, Vol. 13, p 895-904, 1979. 4 tab, 20 ref.

Descriptors: *Industrial wastes, *Water quality, *Pathogenic bacteria, Water pollution effects, Chemical wastes, Path of pollutants, Domestic wastes, Sewage effluents, Coasts, Water chemistry, Aerial photography, Remote sensing, E. Coli, Streptococcus, Viruses, Monitoring, *Mutagens.

Investigations were carried out in a coastal area of the Tyrrhenian Sea, which receives wastes from a chemical manufacturing industry. Industrial wastes are combined with domestic sewage prior to discharge into the sea. Warm and alkaline wastewaters carry large amounts of whitish suspended solids, mainly composed of calcium carbonate, calcium sulphate and magnesium hydroxide, which are responsible for an evident visual

pollution of the sandy shore and of the facing seawater body. Alterations of physical parameters (temperature and pH values) were found to affect the investigated coastal area only to a limited extent. Conversely, aerial photographic investigations afforded a more complete picture of pollution spreading. Infrared and chiefly water-penetration images provided information on the underwater environment, and the resulting findings could be correlated with the particle size analysis of sediment samples. Faecal streptococci represented a considerable proportion of total heterotrophic bacteria in waste and sea-water, whereas concentration of total and faecal coliforms was relatively low. These figures suggested a possible selective inactivation of bacteria in industrial waters, which was supported by the findings of survival tests with three bacterial species (E. coli, Strep. faecalis and S. typhi). Survival of a virus (type 1 poliovirus) and of a virus antigen (hepatitis B surface antigen or HBsAg) was also investigated under various conditions. (Deal-EIS)
W80-00796

THE TEMPERATURE PREFERENCE OF THE THREE-SPINED STICKLEBACK, GASTEROSTEUS ACULEATUS L. (PISCES), COLLECTED AT DIFFERENT SEASONS,
Oslo Univ. (Norway). Inst. for Marine Biology.
K. H. Roed.
Sarsia, Vol. 64, p 137-141, 1979. 3 fig, 1 tab, 17 ref.

Descriptors: *Water temperature, *Fish behavior, *Seasonal, *Sticklebacks, Thermal stratification, Fish physiology, Fish genetics, Aquatic environment, Salinity, Vertical migration, *Acclimation.

Thermal preferences were determined, at different seasons, in an aquarium with stable vertical gradients. The temperature preference was found similar for fish collected in April, June, August, and October, despite different acclimation temperatures and length of acclimation period. Both 0-group and 1-group or older fish chose temperatures less than 11C, and in most cases preferred temperatures between 4 and 8C, which was lower than the in situ temperatures most of the year. The results suggest that the temperature preference of stickleback from Oslofjorden may be genetically determined. (Deal-EIS)
W80-00797

TOXIC EFFECTS OF AQUEOUS EXTRACTS OF EKOFISK CRUDE OIL, CRUDE OIL FRACTIONS, AND COMMERCIAL OIL PRODUCTS ON THE DEVELOPMENT OF SEA URCHIN EGGS,
Tromoe Univ. (Norway). Inst. of Biology and Geology.
I-B. Falk-Petersen.
Sarsia, Vol. 64, p 161-169, 1979. 14 fig, 1 tab, 16 ref.

Descriptors: *Oil, *Toxicity, *Animal growth, Embryonic growth stage, Growth stages, Electron microscopy, Water chemistry, Oil pollution, Mode of action, Sea water, Aromatic compounds, Fuels, *Sea urchins, *Crude oil, *Tissue analysis, *Bioaccumulation.

Embryos of two sea urchin species, Strongylocentrotus droebachiensis and S. pallidus, were studied. Effects were observed directly under the light microscope, and indirectly by electron microscopical investigations (TEM & SEM). Ekofisk crude oil extract had a moderate effect during early development, but affected the embryos strongly during differentiation. BP-gasoline and Kerosine extracts caused effects at rather high total hydrocarbon concentrations, whereas Gas oils, Residue and particularly BP Fuel oil No. 6 extracts were more toxic. TEM-studies revealed an increasing aggregation of electron-dense, lipid-like granules in the cells of affected larvae, SEM-studies did not show differences in surface ultra-structure. (Deal-EIS)
W80-00798

LEAD AND MERCURY IN LESSER SNOW GEESE WINTERING IN LOUISIANA,
Fish and Wildlife Service, Jena, LA. Catahoula National Wildlife Refuge.
L. D. West, and J. D. Newsom.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol. 31, p 180-187, 1977. 2 fig, 3 tab, 28 ref.

Descriptors: *Lead, *Mercury, *Snow Goose, Louisiana, Seasonal, Food habits, Habitats, Hunting, Heavy metals, Chemical analysis, Soil types, Marshes, Migratory birds, *Tissue analysis.

Wintering Lesser Snow Geese (Chen caerulescens) were analyzed for lead and mercury residues and lead shot ingestion. Lead shot ingestion paralleled assimilation of lead residues. Snow geese collected in rice-growing areas had significantly ($P<0.01$) more lead residues than marsh area geese. This was attributed to different soil firmness, feeding habits, and hunting practices in the 2 areas. Recent deposits of lead apparently played a major role in lead shot ingestion because lead residues and shot ingestion were greatest during the hunting season. Mercury residues significantly ($P<0.05$) declined over the wintering season. (Deal-EIS)
W80-00799

5B. Sources Of Pollution

DETERIORATION OF WATER QUALITY DUE TO LONG RANGE TRANSPORT OF AIR POLLUTION,
For primary bibliographic entry see Field 5G.
W80-00458

GROUND-WATER MANAGEMENT TECHNIQUES FOR THE CONTROL OF SALT-WATER ENCROACHMENT IN GULF-COAST AQUIFERS, A SUMMARY REPORT,
Geological Survey of Alabama, Montgomery.
For primary bibliographic entry see Field 2F.
W80-00490

THE EFFECT OF INTENSE FERTILIZATION ON MIGRATION OF NITROGEN COMPOUNDS IN SOIL,
Technical Univ. of Warsaw (Poland). Dept. of Sanitary Environmental Engineering.
For primary bibliographic entry see Field 5C.
W80-00508

URBAN STORMWATER POLLUTION: AN INVESTIGATION OF THE PROBLEM AND ITS CONTROL,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
R. A. Jeung.
Discussions in Environmental Health Planning, January 1978. 211 p, 43 fig, 26 tab, 93 ref.

Descriptors: *Water quality management(Applied), *Water quantity management, *Stormwater runoff, *Sewer systems, *Erosion control, *Sedimentation control, *Management strategies, Non-point source pollution, Water pollution, Water pollution sources, Erosion, Sediment, Urban runoff, Surface runoff, Infiltration, Agricultural runoff, Slopes, Federal Water Pollution Control Act of 1972, Control measures, Implementation strategies, Waste treatment, Municipal water, Sewers, Drainage systems, Soil loss.

The purpose is to identify pollution caused by stormwater runoff and to make local communities aware of this phenomenon. An extensive literature review is undertaken to examine the origin, transport and effects of contaminants that pollute stormwater runoff. Principal sources include heated water from power plants, silt and pesticides from agriculture, mining acid, industrial chemicals and toxins, and municipal wastes. Erosion and sedimentation processes are described and their adverse effects are presented. Urbanization has increased the problem; sediment is identified as the greatest contributor, by volume, to water pollution. Pollution of receiving waters by runoff is significant, in some cases equivalent to or worse than effluent from secondary treatment plants. Urban sources contribute a smaller though equally potent volume of runoff as rural sources. Recommended measures to relieve sewer system runoff load include installation of seepage pits, dutch drains, porous pavements, and a large storage container within the present sewer system. Recommended erosion/sedimentation control measures include more thorough design review of proposed projects and development, vegetative measures such as seeding and use of chemical soil binders, better use of diversion measures such as drains, and better fine-grained sediment control. Land use controls and management strategies are presented. Erosion measures will be most effective at the preliminary site planning phase of a project. Integration of all water quality, solid waste management and land development programs is essential for effective stormwater runoff management strategies to be implemented. (Arnold-NC)
W80-00525

LONG-TERM EFFECTS OF LAND APPLICATION OF DOMESTIC WASTEWATER: VINELAND, NEW JERSEY, RAPID INFILTRATION SITE,
Benham-Blair and Affiliates, Inc., Oklahoma City, OK.
For primary bibliographic entry see Field 5E.
W80-00529

CASING AND LEAK DEPTHS, AND SOLUTE TRAVEL TIMES TO WELLS,
Iowa State Univ., Ames. Dept. of Agronomy.
A. Battikhi, and D. Kirkham.
Water Resources Bulletin, Vol. 15, No. 4, p 1004-1015, August 1979. 2 fig, 1 tab, 13 ref, 1 append. NSF ENG 75-19394.

Descriptors: *Wells, *Leakage, *Well casings, *Travel time, *Water pollution, *Mathematical models, Model studies, Equations, Depth, Solutes, Theoretical analysis, Well screens, Flow nets, Discharge(Water), Laboratory tests, Well radius.

A mathematical solution based on porous media flow was developed for solute travel time to a well as affected by a leak around the upper part of the casing. Consider a well of radius 0.2 meters (m) penetrating, fully, a semiconfined aquifer of thickness 6 m with impermeable casing length of 4.5 m, and screened casing length 1.5 m. Around the upper 1.5 m of the impermeable casing length, there is a highly permeable region (a leak). The radius of influence of the well is 10 m. The porous flow medium has a hydraulic conductivity of 10 m/day and a porosity of 0.25. Between the water table and the water level in the well, there is a steady state, pumped down head difference of 0.3 m. Solute travel time from a point at the bottom of the leak to the well is 2.33 days. If the leak is sealed (grouted), the travel time is 6.24 days. Examples of 6 different geometries were given. Laboratory studies verified the theory. The computations should be useful in the design and protection of water wells from solutes such as from agriculture, industry, strip mines, or sanitary landfills. (Visocky-ISWS)
W80-00579

PERSISTENCE OF CHLORINE IN COOLING WATER FROM ELECTRIC GENERATING STATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W80-00581

TRANSPORT OF VIRUSES THROUGH ORGANIC SOILS AND SEDIMENTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Scineces.
For primary bibliographic entry see Field 5E.
W80-00584

DYE-VECTOR FLOW VISUALIZATION--COOLING WATER MODEL,
State Univ. of New York at Buffalo. Dept. of Civil

Engineering.
For primary bibliographic entry see Field 8B.
W80-00586

RATE CONTROLLING PROCESSES IN THE RELEASE OF RADIUM-226 FROM URANIUM MILL TAILINGS, I. LEACHING STUDY,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
J. S. Nathwani, and C. R. Phillips.
Water, Air, and Soil Pollution, Vol. 11, No. 3, p 301-308, April 1979. 2 fig, 2 tab, 16 ref.

Descriptors: *Leaching, *Radium radioisotopes, *Mine wastes, Laboratory tests, Sampling, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Soils, Particle size, Weathering, Uranium radioisotopes, Mill tailings.

Uranium mill tailings (a pyritic quartz conglomerate ore) obtained from a Canadian operation were leached according to a modification of the method recommended by I.A.E.A. for the leaching of radioactive ions from solidified wastes. A static leach test procedure was chosen to provide information to permit an assessment of hazard due to release of Ra-226 to the environment. Narrow range size fractions (53 to 75 um) of both fresh material obtained directly from a tailings line and material weathered for approximately 10 to 15 yr in a tailing basin were leached for up to 70 days. Distilled water and an acidic synthetic effluent (pH 2.5) were chosen as leachants. Two sequential desorption processes were observed, one before and the other after a leaching period of approximately 10 to 15 days. In the later and more significant stage of desorption, the leaching behavior could be described in terms of a diffusion mechanism. Significantly greater quantities of Ra-226 were leached over relatively short leaching periods by the acidic effluent; thus, the quality of the effluent and percolating water in a tailings disposal area would markedly affect the leachability of Ra from tailings. It was also found that the quantities of Ra-226 leached were significantly influenced by the solid:liquid ratio at low leaching volumes. (Sims-ISWS)
W80-00600

RATE CONTROLLING PROCESSES IN THE RELEASE OF RADIUM-226 FROM URANIUM MILL TAILINGS, II. KINETIC STUDY,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
J. S. Nathwani, and C. R. Phillips.
Water, Air, and Soil Pollution, Vol. 11, No. 3, p 309-317, April 1979. 2 fig, 3 tab, 11 ref.

Descriptors: *Kinetics, *Radium radioisotopes, *Mine wastes, Laboratory tests, Sampling, Pollutants, Path of pollutants, Soils, Particle size, Weathering, Water pollution, Water pollution sources, Uranium radioisotopes, Mill tailings, Desorption.

A kinetic study to examine the leaching mechanisms and the rate controlling steps in the release of Ra from loose granular U mill tailings was undertaken. A batch procedure was chosen in which the kinetics of desorption of Ra-226 from tailings were determined by observing the increase in radioactivity in the solution with time. Intraparticle diffusion was found to be the rate controlling step for desorption periods more than 84 h; for leaching periods less than this, the desorption rate was described by a semi-logarithmic relationship involving either film diffusion or a chemical exchange mechanism as the rate controlling step. It was postulated that the intraparticle diffusion constant, B, correlates and defines the internal structure and hence the binding properties of Ra-226 within the tailings aggregate. Values of the intraparticle diffusion coefficient, D sub p, have been calculated, and the effect of pH on D sub p was studied. It was found that the diffusion coefficient at a specific pH does not significantly differ from 'fresh' or 'weathered' samples. However, a minimum value of D sub p was obtained at a pH of about 7.6. Values of D sub p were found to range from 2.5 X 10 to the minus 13th power to 20.0 X 10 to the minus 13th power sq cm/h. (Sims-ISWS)
W80-00601

DEGRADATION OF SELECTED POLYCYCLIC AROMATIC HYDROCARBONS IN COASTAL SEDIMENTS: IMPORTANCE OF MICROBES AND POLYCHAETE WORMS,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5A.
W80-00613

POLYCHLORINATED BIPHENYLS AND CHLORINATED PESTICIDES IN SOILS OF THE EVERGLADES NATIONAL PARK AND ADJACENT AGRICULTURAL AREAS,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5A.
W80-00618

CHEMICAL SEEPAGE FROM A TAIL WATER RECOVERY PIT TO ADJACENT GROUND WATER,
Nebraska Univ., Lincoln. Inst. of Agricultural and Natural Resources.
R. F. Spalding, M. E. Exner, J. J. Sullivan , and P. A. Lyon.
Journal of Environmental Quality, Vol 8, No 3, p 374-383, July-September 1979. 7 fig, 1 tab, 17 ref.

Descriptors: *Irrigation, *Water reuse, *Seepage, Nitrogen compounds, Nitrates, Groundwater, Water pollution, Water pollution sources, Tracers, Chemicals, Chemical analysis, Sampling, Soils, Soil water, Infiltration, Agriculture, Reuse pits.

Water samples from 10 tail water recovery (reuse) pits and 18 irrigation wells were analyzed for nitrate-nitrogen (N03-N) and atrazine to ascertain concentrations of these heavily utilized products in surface runoff of irrigation water and groundwater beneath irrigated land in Merrick County, Nebraska. Atrazine concentrations in the reuse pit samples ranged from 1.02 to 23.1 micrograms/liter, and in the groundwater samples concentrations ranged from less than 0.005 to 6.96 micrograms/liter. The significant correlation ($r = +0.48$) between N03-N and atrazine in the groundwater samples indicated that atrazine probably enters the groundwater by infiltrating the soil. Tracers study results indicated that seepage from reuse pits during late spring and early summer can increase the concentration of both N03-N and atrazine in groundwater. However, throughout the remainder of the year, when water in the reuse pits generally contains much less N03-N and atrazine, seepage generally dilutes already contaminated groundwater. (Sims-ISWS)
W80-00621

SEDIMENT AND NUTRIENT YIELD FROM RESIDENTIAL CONSTRUCTION SITES,
Wisconsin Univ., Madison. Dept. of Soil Science.
T. C. Daniel, P. E. McGuire, D. Stoffel, and B. Miller.
39-01.

Descriptors: *Runoff, *Sediments, *Nutrients, *Construction, Suspended solids, Phosphorus, Nitrogen, Nitrogen compounds, Nitrates, Nitrites, Water pollution, Water pollution sources, Path of pollutants, Water quality, Land use, Monitoring, Nonpoint pollution.

Runoff from three residential construction site watersheds in southeastern Wisconsin was monitored for a 2-year period. Automatic water quality monitoring equipment was established which sampled each event proportional to flow. Loading rates for sediment and nutrients were developed on an event basis and summed to produce annual loads. Average sediment yield for the three single land use watersheds was 19.2 metric tons/ha per year. Concentrations of 60,000 mg/liter SS were observed for major events; 15,000 to 20,000 mg/liter were common for moderate events. Yields of contaminants from residential construction sites are inherently variable and site dependent. Strict extrapolation or comparison of results to other areas or existing literature values is difficult. However, when compared to runoff data from a simultaneous agricultural watershed investigation, the yield of contaminants from construction sites is considerably higher (19.2 vs. less than 1 metric ton/ha per year of sediment). (Sims-ISWS)
W80-00622

A WATER QUALITY STUDY OF A STRETCH OF THE RIVER TIGRIS,
Mosul Univ. (Iraq). Coll. of Engineering
For primary bibliographic entry see Field 5A.
W80-00623

UPWELLING AND ESTUARY FLUSHING,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W80-00632

A HISTORY OF MERCURY LEVELS IN SWEDISH FAUNA,
Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology.
For primary bibliographic entry see Field 5A.
W80-00649

THE RESPONSE OF COHO SALMON AND GUPPIES TO 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD) IN WATER,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forestry Sciences Lab.
For primary bibliographic entry see Field 5A.
W80-00651

TOTAL AND METHYLMERCURY LEVELS IN THREE SPECIES OF WHELKS,
Shimonoseki Univ. of Fisheries (Japan). Dept. of Food Science and Technology.
For primary bibliographic entry see Field 5A
W80-00656

TRACE METALS IN SEADUCKS OF THE FRASER RIVER DELTA INTERTIDAL AREA, BRITISH COLUMBIA,
Canadian Wildlife Service, Delta (British Columbia).
For primary bibliographic entry see Field 5A.
W80-00657

THE CONCENTRATION AND SPECIATION OF ARSENIC IN MARINE MACRO-ALGAE,
Skidway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5A.
W80-00658

THE SOURCE OF MUDDY ODOR IN BREAM (ABRAMIS BRAMA) FROM THE PORVOO SEA AREA (GULF OF FINLAND),
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst
For primary bibliographic entry see Field 5A.
W80-00661

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH-V EFFECTS ON CALCIUM AND INORGANIC PHOSPHORUS EXCRETION IN THE CARP,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A
W80-00663

UPTAKE, BINDING AND CLEARANCE OF DIVALENT CADMIUM IN GLYCERA DIBRANCHIATA (ANNELIDA: POLYCHAETA),
San Francisco Univ., CA. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-00664

BODY BURDEN OF CHROMIUM, COPPER, CADMIUM AND LEAD IN THE NEUSTONIC COPEPOD ANOMALOCERA PATERSONI (PONTELLIDAE) COLLECTED FROM THE MEDITERRANEAN SEA,

International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W80-00665

ZINC UPTAKE IN MARINE DIATOMS,
Tokyo Univ. of Fisheries (Japan).
For primary bibliographic entry see Field 5A.
W80-00669

MUTAGENIC ACTIVITY IN ORGANIC WASTEWATER CONCENTRATES,
California Univ., Berkeley. School of Public Health.
For primary bibliographic entry see Field 5A.
W80-00670

PHOTOOXIDATION PRODUCTS OF A FUEL OIL AND THEIR ANTIMICROBIAL ACTIVITY,
Academy of National Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
R. A. Larson, T. L. Bott, L. L. Hunt, and K. Rogenmuser.
Environmental Science and Technology, Vol. 13, No. 8, p 965-969, 1979. 4 fig, 3 tab, 24 ref.

Descriptors: *Oil, *Oil spill, *Toxicity, Bioassay, Laboratory test, Yeast, Fungi, Algae, Filamentous algae, Fuel oil, Waste treatment, Decomposing organic matter, Phenols, Hydroperoxides, Photooxidation products, *Tetralin hyperoxide, Vaucheria, Antialgal activity, Photosynthesis.

Photooxidation products of a no. 2 fuel oil were fractionated and examined by gas chromatography mass spectrometry. Among the compound types identified were hydroperoxides (alkylated derivatives of tetralin hydroperoxide), phenolic compounds (highly alkylated phenols and tetrahydronaphthols), and carboxylic acids (substituted benzoic and naphthoic acids). Oil fractions and pure compounds characteristic of the photooxidation products were tested for toxicity to a yeast and several filamentous algae. The species tested varied in their tolerance toward the photoproducts, but hydroperoxides generally showed the highest toxicity; tetralin hydroperoxide, at .00003M, significantly reduced yeast growth. Carboxylic acids had less activity and phenolics were still less active. Tetralin hydroperoxide, at concentrations greater than .00008M, reduced photosynthetic carbon fixation by Vaucheria and increased excretion of fixed carbon. (Katz-EIS)
W80-00671

NEPHROCALCINOSIS IN RAINBOW TROUT SALMO GAIRDNERI RICHARDSON; THE EFFECT OF EXPOSURE TO ELEVATED CO2 CONCENTRATIONS,
Shearwater Fish Farming Carlisle (England).
For primary bibliographic entry see Field 5A.
W80-00674

HEPATOMAS IN ATLANTIC TOMCOD MICROGADUS TOMCOD (WALBAUM) COLLECTED IN THE HUDSON RIVER ESTUARY IN NEW YORK,
Fish and Wildlife Service, Bozeman MT. Fish Cultural Development.
C. E. Smith, T. H. Peck, R. J. Klauda, and J. B. McLaren.
Journal of Fish Diseases, Vol. 2, p 313-319, 1979. 4 fig, 14 ref.

Descriptors: *Fish disease, *Polychlorinated biphenyls, Animal pathology, Fish physiology, Hudson River, Fish populations, Spawning, Powerplants, Industrial wastes, Mode of action, *Atlantic tomcod, *Neoplasms, *Tissue analysis, *Liver, Hepatoma.

Incidental observations of Atlantic tomcod during routine laboratory processing revealed that a portion of the adult population collected during the 1977-78 spawning season had enlarged livers containing dark coloured tumours and other abnormalities. Of the total of 264 livers collected between 16 January and 27 February 1978 and grossly examined for prevalence of abnormalities, 25% appeared to contain neoplastic nodules and hepatocellular carcinoma. One liver contained a massive tumour (7 x 12 mm) that involved approximately 60% of the liver. The exact causes of the high prevalence of hepatocellular carcinoma are unknown but polychlorinated biphenyls (PCBs) are suspected of having a possible role. The Hudson River is known to contain elevated concentrations of PCBs. Twelve tomcod livers from the 1977-78 spawning population representing both normal and hepatoma conditions contained concentrations of PCBs ranging from 10.9 to 98.2 ppm (mean of 37.5 ppm). (Deal-EIS)
W80-00675

EFFECTS OF TREATED EFFLUENT ON A NATURAL MARSH,
Canada Centre for Inland Waters, Burlington (Ontario).
A. Mudroch, and J. A. Capobianco.
Journal of the Water Pollution Control Federation, Vol. 51, No. 9, p 2243-2256, 1979. 13 fig, 6 tab, 44 ref.

Descriptors: *Nutrients, *Sewage effluents, *Marshes, Marsh plants, Freshwater marshes, Metals, Nitrogen, Phosphorus, Lead, Chromium, Zinc, Dominant organisms, Plant groupings, Wastewater treatment, Water chemistry, Municipal wastes, Bottom sediments, *Glyceria.

Long-term effects of poor-quality wastewater treatment plant effluent on a natural marsh on the western shore of Lake Ontario were studied. The major contributor of N and P to the marsh area was the treatment plant discharge. Metal concentrations in the water were generally low (.001 to .090 mg/l). Increased concentrations of Pb, Cr, Zn, N, P, and organic C (up to 300 microgram/g, 90 microgram/g, 210 microgram/g, 2.34%, 1.10%, and 0.87% of sediment dry weight, respectively) were found in the sediment vertical profile obtained from the marsh area. The shoot standing crop of the dominant plant species (Glyceria grandis) was associated with amounts of P, N, and organic C in the sediments. (Deal-EIS)
W80-00677

THE EFFECT OF ZINC ON THE INCREASE IN LENGTH OF FIVE SPECIES OF INTERTIDAL FUCALES,
Trondheim Univ. (Norway).
T. Stromgren.
Journal of Experimental Marine Biology and Ecology, Vol. 40, p 95-102, 1979. 4 fig, 19 ref.

Descriptors: *Zinc, *Toxicity, *Growth rates, *Phaeophyta, Length, Size, Plant physiology, Metals, Water chemistry, Water quality, Metabolism, Marine algae, Fucus, Ascophyllum.

The growth rate of Pelvetia canaliculata, Fucus spiralis, F. vesiculosus, F. serratus, and Ascophyllum nodosum was measured in six different concentrations of zinc (0.025 14mg/1) during a period of ten days. No significant growth response was observed at 0.1 mg/1 of zinc. A significant reduction of growth during the first two to three days of exposure to 1.4 mg/1 or more was followed by no or small further decline. Apices of A. nodosum from localities with different background load of zinc (0.1-0.5 mg/1 and < 0.01 mg/1) showed no difference in response to 2.6 mg/1 of zinc. (Deal-EIS)
W80-00682

THE ROLE OF MELANO-MACROPHAGE CENTRES IN IRON STORAGE IN NORMAL AND DISEASED FISH,
Stirling Univ. (Scotland). Unit of Aquatic Pathobiology.
For primary bibliographic entry see Field 5A.
W80-00683

STUDY OF METAL CONTENTS OF ELASMOBRANCH FISHES: PART I-METAL CONCENTRATION IN THE MUSCLE TISSUES OF A DOGFISH, SQUALUS MITSUKURII,
Tokyo Univ. (Japan). Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 5A.
W80-00685

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO 1977-1978. VOLUME III: CHEMICAL AND PHYSICAL INVESTIGATIONS.
National Marine Fisheries Service, Galveston, TX. Southeast Fisheries Center.
For primary bibliographic entry see Field 5C.
W80-00692

THE LOWER BAY COMPLEX,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2J.
W80-00695

CHEMICAL POLLUTANTS OF THE NEW YORK BIGHT; PRIORITIES FOR RESEARCH,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
For primary bibliographic entry see Field 5C.
W80-00697

ON THE THEORETICAL BASIS OF MODELLING THE QUALITY OF SURFACE AND SUBSURFACE WATERS,
Deutsche Akademie der Wissenschaften zu Berlin (German D.R.). Inst. fuer Geographie and Geookologie.
P. Mauersberger.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 14-23, 1978. 4 ref.

Descriptors: *Water quality, *Surface waters, *Subsurface waters, *Mathematical models, Theoretical analysis, Hydrologic cycle, Model studies, Equations, Entropy, Analytical techniques, Ecosystems, Thermodynamics, Analytical techniques, Momentum equation, Continuity equation, Energy equation, Mathematical studies, Chemical processes, Biochemical processes.

The system of equations characterizing deterministic water quality models takes into account the conservation of mass and momentum, the energy balance, and equations describing chemical, biochemical, and biological processes. It was pointed out that this system of equations must be completed by adding the entropy principle. The mutual effects of entropy-producing and entropy-reducing processes regulate the structure, state, and development of the subsystems of the hydrological cycle. (See also W79-00379) (Humphreys-ISWS)
W80-00700

A DYNAMIC MODEL OF THE CHEMICAL NUTRIENT SYSTEM FOR RESEARCH OF THE ECOLOGICAL CONSEQUENCES IN NATURAL WATER,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
A. V. Leonov.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 24-36, 1978. 5 fig, 1 tab, 9 ref.

Descriptors: *Nutrients, *Water quality, *Mathematical models, *Bioindicators, Ecosystems, Model studies, Biochemical oxygen demand, Theoretical analysis, Analytical techniques, Computer models, Bacteria, Protozoa, Aquatic microorganisms, Metabolism, Productivity, Organic matter, Primary productivity, Secondary productivity, Equations, Dynamic models.

This paper presented a mathematical model of the ecological-biochemical system. The model is intended for investigation of the interaction o

chemical components with the living matter of natural water and of the transformation of organic and inorganic substances and of biochemical oxygen uptake. The transformation of dissolved organic matter, of organic and inorganic phosphorus compounds, and oxygen uptake were discussed on the basis of computer simulation results. The phosphorus compounds turnover intensity along different transformation pathways was estimated. The calculations of the quantity of transforming matter showed that significant mistakes may be received in the evaluation of some included metabolism transforming compounds directly from experimental data if the formation of secondary matter is not taken into account. The conclusion must be drawn with great caution on the basis of these estimations. For example, formation of the secondary organic matter can give the illusion of stability of the initial organic matter to biochemical destruction in the period of minimal biomass of the bacteria and maximal biomass of the predators. The consumption of oxygen is the best indication of biochemical activity of the non-photosynthetic system in this case, with the total combination of, for example, the data on the accumulation of CO2 and mineral nitrogen compounds. The mathematical model considered may be used for analysis of the following: (1) complex observed results in dark laboratory conditions; (2) data on the dynamics of components under the photosynthetic layer of simple hydrodynamic models; (3) as the basis for a sub-model of more complex models of real natural productivity systems; and (4) for the investigation of self-purification processes in water. (See also W79-00379) (Humphreys-ISWS)
W80-00701

AN EFFORT FOR MODELLING THE TRANSPORT OF MICROPOLLUTANTS IN RIVERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Somlyody.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 39-49, 1978. 5 fig, 20 ref.

Descriptors: *Water pollution, *Mathematical models, *Rivers, Heavy metals, Model studies, Pollutants, Movement, Theoretical analysis, Analytical techniques, Mercury, Lead, Cadmium, Bottom sediments, Physicochemical properties, Suspended solids, Numerical analysis, Spatial distribution, *Micropollutant transport, *Hungary, *River Sajo(Hungary), Mass balance.

The modelling of the transport of heavy metals differs essentially from that for other pollutants. Basically, heavy metals can be found in three states: in dissolved and in solid form in the water body and in the polluted bottom sediment. Their transport is affected by several physical, physicochemical, and biochemical processes, such as convection, dispersion, settling, deposition, re-entrainment, change between dissolved and solid form, aggregation, etc. In general, the solid form and the bottom sediment are characterized by their particle size distribution. A mathematical model of one-dimensional character in space was worked out on the basis of mass balance equations written for all three states. For the numerical solution, an explicit method of finite differences was applied. The numerical stability was proved. A hypothetical example was presented in which the effect of floods was studied beside continuous pollutant discharge. The computed variations correspond to the expected pattern gained from measurements performed on the River Sajo. However, to achieve this, the distribution of particle sizes also had to be taken into consideration. (See also W79-00379) (Humphreys-ISWS)
W80-00702

HYDROLOGICAL AND GEOCHEMICAL MASS BALANCE IN SMALL FORESTED AND AGRICULTURAL BASINS,
Corporation for Engineering, Geological and Hydrological Investigation, Prague (Czechoslovakia). Stavebni Geologie.
For primary bibliographic entry see Field 2A.
W80-00703

EFFECTS OF THE CONSTRUCTION OF A BROAD WATERWAY ON THE WATER QUALITY OF THE DOUBS (EFFETS DE LA CANALISATION A GRAND GABARIT SUR LA QUALITE DES EAUX DU DOUBS),
Electricite de France, Chatou. Direction des Etudes et Recherches.
E. Chalon, D. Momal, and C. Sabaton.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 59-67, 1978. 7 fig, 3 ref.

Descriptors: *Water quality, *Rivers, *Mathematical models, Calibrations, Analytical techniques, Dissolved oxygen, Model studies, Biochemical oxygen demand, Foreign research, River flow, On-site data collections, Reaeration, Biodegradation, Water temperature, Discharge(Water), *France, *Doubs River(France).

The construction of a broad waterway between the Rhone and the Rhine will strongly modify the hydraulic regime of the Doubs River (increase in depth and construction of overcrested weirs). The effect of these modifications upon the dissolved oxygen levels of the river has been studied. The originality of the method used lies in the calibration of a mathematical simulation model with actual data; the data used consist of time series (1969-1975) of hydrological, meteorological, and water quality parameters such as river flow, wind speed, air temperature and humidity, dissolved oxygen, and 5 day BOD. The model allows the statistical evaluation of the possible effect of future changes upon the dissolved oxygen level of the Doubs River, and, therefore, illustrates a methodology of impact assessment of a broad navigation system on the water quality of a river. (See also W79-00379) (Humphreys-ISWS)
W80-00704

MASS TRANSFER MODELS OF SORPTION AND DESORPTION OF RADIONUCLIDES BY AQUATIC PLANTS,
Institute of Meteorology and Water Management, Warsaw (Poland).
For primary bibliographic entry see Field 2A.
W80-00705

ON THE CHOICE OF BOUNDARY CONDITIONS FOR ONE-DIMENSIONAL MODELS OF ESTUARINE WATER QUALITY,
University Coll., Dublin (Ireland). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W80-00706

THE BIOCENOTIC MODEL,
Landesanstalt fuer Umweltschutz Baden-Wurttenberg, Karlsruhe (Germany, F.R.).
M. Boes.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 86-95, 1978. 5 fig, 8 ref.

Descriptors: *Model studies, *Water quality, *Rivers, *Water pollution, *Self-purification, Aquatic environment, Oxygen demand, Mathematical models, On-site investigations, Food chains, Management, Nutrients, Flow, Velocity, Biochemical oxygen demand, Hydraulic engineering, Aeration, Oxidation, Flow characteristics, *Germany, Biocenotic model, Oxygen budget, Organic pollution.

The biocenotic model is a quality model for flowing waters, predicting the oxygen budget and the organic pollution for given loads. In contrast to the black-box models, it is a physically based, dynamic model. The essence of the biocenotic model is the 'model biocenosis'--a complex control system in which the natural society of organisms is described in a group pattern. The principal classification criterion is the rank in the food chain. The model is applicable to very different water courses without the need for changing the structure or parameters of the 'model biocenosis' and is, therefore, an easily handled planning instrument. It has been used for planning in the field of water quality management. Since 1973, model calculations have been carried out for the rivers Neckar and Enz, Danube from Schwenningen to Ulm, Fils, Schussen, Murg, Leopoldskanal/Breisgauer Bucht, and Schmiedbach, rivers with low discharge rates from 0.005 to 30 cu m/sec, water depths from 0.1 to 8 m, river widths from 1 to 175 m, and flow velocities from 0.02 to 0.8 m/s. There was no need to adapt the regulating elements of the model to any of the rivers listed. (See also W79-00379) (Humphreys-ISWS)
W80-00707

THE USE AND LIMITATIONS OF A TWO-DIMENSIONAL MIXING MODEL FOR RIVERS,
Research Inst. for Water Resources Development, Budapest (Hungary)
L. Somlyody.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 96-105, 1978. 8 fig, 15 ref.

Descriptors: *Model studies, *Rivers, *Mixing, *Water quality, Flow characteristics, Flow, Spatial distribution, Variability, Dispersion, Diffusion, Laboratory tests, Open channels, Open channel flow, On-site tests, Mass transfer, Mathematical models, Two dimensional models.

In wide streams the variations in the water quality parameters are fundamentally affected by transverse mixing. Therefore, using a new concept a two-dimensional mixing model was developed recently which serves as a basis for water quality models. The use of the model was illustrated by 3 examples in which computed and measured concentrations were compared. Good agreement was achieved in all the cases. However, in the last 2 examples, the spatial variation of the dispersion coefficient also had to be taken into consideration. This fact limits the use of the model as such detailed information is rarely available in practice. The expressed three-dimensional character of the flow (e.g., in the presence of sharp bends, contractions, and expansions) causes the second limiting factor. In such cases, the dispersive transport may not be described by the Frickian law; the dispersion coefficient may vary strongly in space and may become negative, too. To support this, 2 examples were given: a laboratory model of a curved open channel and a natural stream. (See also W79-00379) (Humphreys-ISWS)
W80-00708

USE OF WATER QUALITY VARIABLES FOR ESTIMATION OF WATER QUANTITY CHARACTERISTICS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-00709

ADAPTATION OF THE EPAECO MODEL TO A LAKE IN CENTRAL FINLAND,
National Water Board of Finland, Helsinki
For primary bibliographic entry see Field 2L.
W80-00710

ENERGY EXCHANGE BETWEEN DEEP LAKES AND THE ATMOSPHERE AND THE CONSEQUENCES FOR THE WIND-MIXED LAYER DYNAMICS.
Haskoning, Nijmegen (Netherlands).
For primary bibliographic entry see Field 2L.
W80-00713

NUTRIENT EXCHANGE BETWEEN VOLUME ELEMENTS OF LARGE LAKES,
Canada Centre for Inland Waters, Burlington (Ontario).

For primary bibliographic entry see Field 2H.
W80-00716

WATER QUALITY IN LENTIC WATER BODIES (LAKES AND RESERVOIRS),
Salford Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W80-00717

NATURAL CONTROL OF THE CHEMICAL COMPOSITION OF WATER DURING THE INFILTRATION PROCESS--FIRST RESULTS (ACQUISITION DE LA COMPOSITION CHIMIQUE DE L'EAU AU COURS DE L'INFILTRATION EN MILIEU NATUREL--PREMIERS RESULTATS D'UNE ETUDE EXPERIMENTALE),
Bureau de Recherches Geologiques et Minieres, Orleans (France).
M. Bonnet, and A. Landreau.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 213-224, 1978. 8 fig, 2 tab, 10 ref.

Descriptors: *Groundwater, *Infiltration, *Water quality, *On-site investigations, Precipitation(Atmospheric), Water pollution, Water chemistry, Porous media, Movement, Dissolved solids, Strontium, Sodium, Calcium, Aquifers, Water properties, Carbonates, Unsaturated flow, On-site tests, Hydrogen ion concentration, Magnesium, Potassium.

The object of this study was to define the various mechanisms involved in the natural controls of the chemism of an underground aquifer fed only by precipitation. This investigation was conducted with the view to develop a conceptual model of the evolution of the chemical composition of the water, in which the water-transfers would also be involved. The study was performed on an experimental site so that all major natural factors involved in the control of the water chemism would come into play. The non-saturated zone is made up of silt, 3 m thick, and chalk, 5 m thick. The first results pertaining to the evolution of the water quality were presented. The salt content gradually increases as the water progresses through the silt, then it falls abruptly as the water passes through the weathered chalk. The equilibrium dissolved silica-silicated rocks is quickly reached within the first meter. The Na and Ca contents vary suddenly as the water flows through clayey layers (base exchange) and weathered chalk (precipitation). The prospects and results expected from this investigation were also discussed. (See also W79-00379) (Humphreys-ISWS)
W80-00719

COMPUTATION OF THE ADVANCEMENT OF GROUNDWATER POLLUTION DUE TO PETROLEUM PRODUCTS ORIGINATING FROM A KNOWN SOURCE OF CONTAMINATION (LE CALCUL DE LA PROPAGATION DE LA POLLUTION DES EAUX SOUTERRAINES PAR DES MATERIAUX HUILEUX, PROVENANTS D'UNE SOURCE DE LA POLLUTION CONNUE),
Vyzkumny Ustav Vodohospodarsky, Bratislava (Czechoslovakia).
J. Sumbal.
In: Modelling the Water Quality of the Hydrological Cycle; Proceedings of the Baden Symposium, September 1978: International Association of Hydrological Sciences, Publication No. 125, p 225-236, 1978. 1 fig, 2 tab, 8 ref.

Descriptors: *Water pollution, *Groundwater, *Mathematical models, *Path of pollutants, Water pollution sources, Oil, Computer models, Model studies, Analytical techniques, Equations, Organic compounds, Movement, Porosity, Aquifer characteristics, Water temperature, Infiltration.

Pollution of groundwater by petroleum products occurs firstly as the movement of oil in the liquid phase, being separated from the water and then as the propagation of small quantities of oil dissolved in the water. The computation program presented shows a good agreement between computed results and measurements, performed in the nature of oil advancement in the liquid phase. The second program, of which the principles were explained, allows one to compute the isolines of pollution concentration originating from oil spread on the surface computed by the first program. (See also W79-00379) (Humphreys-ISWS)
W80-00720

PETROLEUM HYDROCARBONS IN URBAN RUNOFF,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., and J. V. Hunter.
Water Resources Bulletin, Vol. 15, No. 4, p 1096-1105, August 1979. 2 fig, 5 tab, 8 ref.

Descriptors: *Urban runoff, *Organic compounds, *Oil, *Water pollution, Water pollution sources, Pollutants, Path of pollutants, Water quality, Water quality control, Storm runoff, Urban drainage, Urbanization, Cities, Land use, Sampling, Data processing, Model studies, Mathematical models, Analytical techniques.

Estimates were made of petroleum hydrocarbon pollution loadings reaching the Delaware Estuary by determining storm event loadings of hydrocarbons from 4 storm sewers draining areas of different land uses. Although refinery effluents constituted the largest source of petroleum pollution in 1975, it appears that after completion of currently required treatment processes, urban runoff will be the largest remaining source of petroleum pollution. The petroleum in urban runoff resembles used crankcase oil in composition and contains toxic chemicals such as polynuclear hydrocarbons. Further research is clearly desirable. Remedial programs to control such pollution may be warranted on the basis of information now available. (Sims-ISWS)
W80-00730

CONTAMINATION POTENTIAL IN THE SILURIAN DOLOMITE AQUIFER, EASTERN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
M. G. Sherrill.
Geological Survey Water-Resources Investigations 78-108 (open-file map), May 1979. 2 sheets, 11 ref.

Descriptors: *Water quality, *Groundwater, *Dolomite, *Aquifers, *Surface-groundwater relationships, Aquifer characteristics, Water pollution sources, Subsurface mapping, Groundwater movement, Groundwater recharge, Transmissivity, *Silurian dolomite aquifer(WI), *Eastern Wisconsin, *Groundwater contamination potential.

The Silurian dolomite aquifer is used for water supply in much of a 14-county area bordering Lake Michigan in eastern Wisconsin. Because of the rapidity of ground-water movement, the aquifer is susceptible to contamination by waters percolating downward from surface sources. Maps showing the distribution of permeability, the thickness of unconsolidated materials, and the depth to the water table are combined to show areas where the dolomite aquifer has the greatest contamination potential. Several areas have above-normal potential for contamination. These include the Casco-Luxemburg area of Kewaunee County, the area south of Chilton in Calumet County, a part of western Manitowoc County, drainageway areas in Sheboygan County, the Byron-Campbellsport area of Fond du Lac County, the Sussex-Lannon-Cedarburg areas of Waukesha and Ozaukee Counties, and the Racine-Burlington areas of Racine County.
W80-00757

EVALUATION OF A DIGITAL MODEL FOR ESTUARINE WATER QUALITY SIMULATION IN WASTE ALLOCATION STUDIES,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. E. Seaburn, M. E. Jennings, and M. L. Merritt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 820, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-54, 1979. 50 p, 20 fig, 8 tab, 12 ref.

Descriptors: *Path of pollutants, *Estuaries, *Model studies, *Waste water(Pollution), *Mathematical models, Tidal effects, Mass transfer, Water quality, Dissolved oxygen, Biochemical oxygen demand, Chlorides, Nitrogen, *Finite difference method, *Steady state conditions, Florida, *Pasco County, *Citrus County, *Pinellas County.

Hydrologic and water-quality data were collected on 4 estuaries in Pasco, Citrus, and Pinellas Counties, Florida, to evaluate modeling results. Current and predicted waste loading of the four estuaries was simulated by use of a two-dimensional steady-state, intertidal-condition model. Concentrations of DO, carbonaceous and nitrogenous BOD, and chloride were simulated as averages over a tidal cycle. General equations for the model are based on the law of conservation of mass. Assumption of steady-state required that water-quality data for calibration be averaged over an appropriate time cycle with respect to volume and cross-section. Diurnal DO fluctuation was determined in 2 estuaries for evaluating the influence of photosynthesis and respiration. The estuary model is best applied by calibrating it for a particular set of observed conditions, and then using this calibrated model for sensitivity analyses without attempting to verify the chosen parameter values against a second set of conditions. Sensitivity analyses included dispersion coefficient, decay rates, photosynthesis, and respiration. (Woodard-USGS)
W80-00761

WATER-QUALITY ASSESSMENT OF RUNOFF FROM A RURAL HIGHWAY BRIDGE NEAR TALLAHASSEE, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. A. Irwin, and G. T. Losey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 359, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-1, 1978. 27 p, 2 fig, 7 tab, 10 ref.

Descriptors: *Water quality, *Runoff, *Bridges, Highways, Water pollution sources, Sampling, Water analysis, Trace elements, Pesticides, Bacteria, Oil, Suspended solids, Chemical analysis, Precipitation(Atmospheric), Streamflow, Evaluation, Regression analysis, Florida, *Automotive vehicles, *Leon County(Fla), *Gadsden County(Fla), *Ochlockonee River, U.S. Highway 27.

Runoff from a rural highway bridge on U.S. 27 near Tallahassee, Florida, was found to have an insignificant water-quality loading impact on the Ochlockonee River. Potential annual-runoff loads on the bridge surface for virtually all constituents studied were less than one percent of those transported by the river at the study site. The loading rates for some parameters were significantly related to traffic counts, but the regression equations were limited to traffic ranges between 3,800 to 4,200 vehicles per day in 1977-78. Precipitation samples indicated that a significant percentage of the constituent loading to the bridge surface is from atmospheric deposition. (Woodard-USGS)
W80-00767

A PRELIMINARY APPRAISAL OF THE IMPACT OF AGRICULTURE ON GROUNDWATER AVAILABILITY IN SOUTHWEST GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-00770

STORMWATER-RUNOFF DATA FOR A COMMERCIAL AREA, BROWARD COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.

For primary bibliographic entry see Field 4C.
W80-00772

ESTIMATING THE GAS AND DYE QUANTITIES FOR MODIFIED TRACER TECHNIQUE MEASUREMENTS OF STREAM REAERATION COEFFICIENTS,
Geological Survey, NSTL Station, MS. Water Resources Div.
R. E. Rathbun.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 015, Price Codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-27, February 1979. 42 p, 5 fig, 7 tab, 29 ref.

Descriptors: *Reaeration, *Streams, *Measurement, *Tracers, *Dye releases, Tracking techniques, Flow rates, Dye dispersion, Mixing, Equations, Estimating, *Reaeration coefficient, *Nonradioactive tracers, Hydrocarbon gases, Rhodamine-WT dye, Time of travel.

Measuring the reaeration coefficient of a stream with a modified tracer technique has been accomplished by injecting either ethylene or ethylene and propane together and a rhodamine-WT dye solution into the stream. The movement of the tracers through the stream reach after injection is described by a one-dimensional diffusion equation. The peak concentrations of the tracers at the downstream end of the reach depend on the concentrations of the tracers in the stream at the injection site, the longitudinal dispersion coefficient, the mean water velocity, the length of the reach, and the duration of the injection period. The downstream gas concentrations also depend on the gas desorption coefficients of the reach. The concentrations of the tracer gases in the stream at the injection site depend on the flow rates of the gases through the injection diffusers, the efficiency of the gas absorption process, and the stream discharge. The concentration of dye in the stream at the injection site depends on the flow rate of the dye solution, the concentration of the dye solution, and the stream discharge. Equations for estimating the gas flow rates, the quantities of the gases, the dye concentration, and the quantity of dye together with procedures for determining the variables in these equations are presented. (Woodard-USGS)
W80-00773

A MORPHOMETRIC STUDY OF LEAD AND COPPER EFFECTS ON DIATOMA TENUE VAR. ELONGATUM (BACILLARIOPHYTA),
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5A.
W80-00782

BIOGEOCHEMISTRY OF SELECTED HEAVY METALS IN WESTERN PORT, VICTORIA, AND USE OF INVERTEBRATES AS INDICATORS WITH EMPHASIS ON MYTILUS EDULIS PLANULATUS,
Victoria Ministry for Conservation, Melbourne (Australia).
For primary bibliographic entry see Field 5A.
W80-00788

UPTAKE OF CADMIUM BY THE EELGRASS ZOSTERA MARINA,
Adelphi Univ., Garden City, NY. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-00789

RESPONSES OF MARINE FOULING COMMUNITIES TO SEWAGE ABATEMENT IN KANEOHE BAY, OAHU, HAWAII,
Research Corporation of the University of Hawaii, Honolulu.
E. B. Rastetter, and W. J. Cooke.
Marine Biology, Vol. 53, p 271-280, 1979. 4 fig, 2 tab, 24 ref.

Descriptors: *Fouling, *Sewage effluents, *Dominant organisms, Cyanophyta, Diatoms, Biological communities, Outlets, Nutrients, Domestic wastes, Water chemistry, Marine algae, Biomass, Kaneohe Bay(HI), *Species diversity.

The development of marine fouling communities was followed as part of a sewage abatement study in Kaneohe Bay. Panels immersed near the outfall during sewage discharge were dominated by dense mats of blue-green algae and diatoms. This mat was significantly lighter at this station when sewage did not flow into the bay, and it never developed on panels within the same sector of the bay but away from the influence of the outfall. Taxonomic diversity, and the frequency of filamentous algae and the serpulid Hydroides elegans were reduced near the outfall during discharge. It is suggested that this reduction in diversity and abundance of certain key foulers is due to competitive exclusion by the dense blue-green and diatom mats, and is not a direct effect of the sewage effluent. (Deal-EIS)
W80-00791

EFFECTS OF ARTIFICIAL EUTROPHICATION ON THE METABOLISM OF THE JAPANESE OYSTER CRASSOSTREA GIGAS,
Tohoku Univ., Sendai (Japan). Dept. of Fisheries.
K. Mori.
Marine Biology, Vol. 53, p 361-369, 1979. 8 fig, 3 tab, 14 ref.

Descriptors: *Eutrophication, *Oysters, *Toxicity, Animal metabolism, Mortality, Industrial wastes, Domestic wastes, Mode of action, Commercial shellfish, Animal physiology, Respiration, Lipids, Seasonal.

Matsushima Bay, one of the richest oyster-culture areas in Japan, is subject to heavy artificial eutrophication, mainly from the inflow of city and factory sewages. The physiological activity in the oyster Crassostrea gigas in hanging cultures (i.e., suspended in wire-mesh cages) in this embayment declines markedly with progressive development of the gonads. This decline in activity coincides with eutrophication-induced accumulation of fatty material in the epithelia of the digestive organs. The oyster is thereby forced to depend on these accumulated fats for respiratory substrates in order to maintain its increased physiological needs. However, the fats are inefficient energy sources for the oyster and hence, during each spawning season, 50% mortality occurs. In addition, such phenomena as over-maturation of the gonad and disturbance of the lipid and steroid metabolism seem to accelerate this mass mortality. On the basis of the results, the author has compiled a schematic diagram which illustrates the possible causes of mass mortality among C. gigas in an eutrophic environment such as Matsushima Bay. (Deal-EIS)
W80-00792

THE ROCK OYSTER SACCOSTREA GLOMERATA AS AN INDICATOR OF TRACE METALS IN HONG KONG,
Fisheries Research Station, Aberdeen (Hong Kong).
For primary bibliographic entry see Field 5A.
W80-00793

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5A.
W80-00796

LEAD AND MERCURY IN LESSER SNOW GEESE WINTERING IN LOUISIANA,
Fish and Wildlife Service, Jena, LA. Catahoula National Wildlife Refuge.
For primary bibliographic entry see Field 5A.
W80-00799

5C. Effects Of Pollution

EUTROPHICATION AND REHABILITATION OF SURFACE WATERS,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 811-814.

Descriptors: *Eutrophication, *Lake restoration, *Water pollution control, *International cooperation, *Nutrients, Lakes, Nitrogen, Phsophates, Phosphorus, Sewage treatment, Legislation, Regulation, Water utilization, Reservoirs, Potable water, Impoundments, Chemical precipitation, Nutrient removal, Beneficial use, Training, Industrial wastes, Effluents, Waste water disposal, Water pollution effects, Ecology.

The United Nations Environment Program sponsored an international symposium on eutrophication and rehabilitation of surface waters, held September 1976 at Karl-Marx-Stadt, East Germany; this report outlines its objectives and recommendations. The latter include laws, standards, and guidelines for protecting surface waters and preventing eutrophication; these include regulations for optimum water use, reduction of wastewater nutrient content prior to disposal, establishment of protected zones and conservation areas, and monitoring systems. Eutrophication prevention measures: (1) elimination of nutrient sources prior to drinking-water reservoir construction; (2) improvement of sanitation and sewage disposal systems, particularly in impoundment basins; (3) proper sewage treatment if agricultural or forestry use is intended; (4) recycling and recovery of fertilizing materials from industrial wastes prior to discharge; (5) protection of water from heated effluents; (6) runoff and erosion control; (7) development of substitutes for detergents; (8) international cooperation. Methods for rehabilitation of eutrophic waters include: (1) desludging of eutrophic waters, (2) drainage of nutrient-enriched hypolimnetic waters; (3) artificial aeration, (4) aquatic plant control, (5) nutrient precipitation from water and sediment, and (6) improving water flow. Beneficial use can be made of harvested plants, and nutrients in eutrophic waters are suitable for fisheries improvement. Training and educations should be promoted. (Lynch-Wisconsin)
W80-00417

THE ENVIRONMENTAL IMPACTS OF THE ASWAN HIGH DAM,
Academy of Scientific Research and Technology, Cairo (Egypt).
M Hafez, and W K. Shenouda.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1777-1786.

Descriptors: *Reservoirs, *Aswan High Dam(Egypt), *Environmental effects, *Water storage, *Ecosystems, Artificial lakes, Rainfall, Dams, Impoundments, Nile River, Sudan, Lake Nasser(Egypt), Lake Nuiba(Sudan), Tourism, Rivers, Fisheries, Agriculture, Flood protection, Social impact, Public health, Schistosomiasis, Eutrophication, Ecology, Hydroelectric power, Navigation, Cost-benefit analysis.

Completion in 1968 of the Aswan High Dam on the Nile River in Egypt has profoundly affected the entire Nile Basin in Egypt and the Sudan, but benefits far outweigh negative effects. The dam created a 500-km lake, known as Lake Nassar in Egypt and Lake Nubia in the Sudan, which provides for 'century storage' of water which accumulates during the 50-year cycle of heavier rainfall and is used during the 50-year period of reduced rainfall. Benefits include: (1) a sufficient water supply for agricultural and industrial growth, (2) doubling of electric power output, (3) greatly augmented fishery in Lake Nasser, (4) high and low flood protection, (5) improved navigation, and (6) increased tourism. Negative effects: (1) inundation of vast areas of land requiring relocation of 50,000 people and several historical monuments, (2) a change from a riverine to a lacustrine system; (3)

regulation of the once-variable water flow, with reduction of flow to the Mediterranean by as much as 100 cu km/yr; (4) loss of 60 million cu m/yr reservoir capacity due to siltation, with increased river bed and bank erosion; (5) increased evaporation from the reservoir from six to 10 cu km/yr; (6) alteration of shoreline ecology; (7) an anaerobic lake hypolimnion, (8) alteration of river morphology, water quality, and ecology, including eutrophication and excessive plant growth; (9) social changes as a result of improved agriculture, fishing, and employment; (10) an increase in schistosomiasis; and (11) increased irrigation canal salinity. (Lynch-Wisconsin)
W80-00446

DETERIORATION OF WATER QUALITY DUE TO LONG RANGE TRANSPORT OF AIR POLLUTION,
For primary bibliographic entry see Field 5G.
W80-00458

ESTABLISHMENT OF QUALITY CRITERIA FOR WATER USE IN AUSTRALIA,
Caulfield Inst. of Tech., Victoria (Australia). Water Studies Centre.
For primary bibliographic entry see Field 6E.
W80-00460

PHYSIOLOGICAL ADAPTATIONS OF SALMONID FISHES (SALMO CLARKI HENSHAWI, SALMO GAIRDNERI, AND ONCORHYNCHUS KISUTCH) TO ALKALINE SALINE WATER AND THEIR TOXIC EFFECTS,
Nevada Univ. System, Reno. Desert Research Inst.
For primary bibliographic entry see Field 2H.
W80-00488

IMPACTS OF A LARGE RECREATIONAL DEVELOPMENT ON WATER QUALITY IN A SEMI-PRIMITIVE ENVIRONMENT,
Montana State Univ., Bozeman. Inst. of Applied Research.
D. G. Stuart, G. Roemhild, T. T. Williams, J. J. Jezeski, and J. E. Schillinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 220, Price codes: A05 in paper copy, A01 in microfiche. Report No. NSF/RA-761543. December 1976. 70 p, 23 fig, 10 tab, 10 ref, 3 append. GI29908x, GI29908x1, GI39592.

Descriptors: *Montana, *Water quality, *Land development, *Recreation, Sewage, Effluents, Hydrology, Groundwater, Water analysis, Water pollution, Water treatment, Water resources, Surface waters, Land use, Recreation facilities, Environmental effects, Recreation wastes.

Large recreational developments such as the Big Sky Resort in Montana can be compatible with high water quality found in semi-primitive areas, if developments are properly sited, carefully planned, and money is spent to adequately implement plans. Construction commenced in 1970 for the multi-million dollar resort in the West Fork basin of the Gallatin River, southwestern Montana. Research involved surface water and groundwater quality studies of the Gallatin Canyon area. Physicochemical and bacteriological parameters as well as water quantity were studied prior to, during, and after construction. Samples from 1970-1974 revealed considerable surface streamflow variation seasonally and annually; however, streamflow changes from commercial development were not detected. Water table elevations in two wells dropped from 108-124 in and 78-81 in between August 1972 and October 1973. The drop resulted drom increased pumping for domestic and irrigation purposes. Groundwater and surface waters from Gallatin River and tributaries are generally of high water quality and little degradation evidence was observed except for some transient sediment slugs during heavy construction resulting in aquatic insect population changes. Aquatic insect populations doubled near sewage lagoons compared to other sites. Although the resort is not yet fully developed, surface and groundwater quality could be maintained unless sewage-treatment, a proposed 'no discharge' system, fails to function according to design. (Danovich-Wisconsin)
W80-00498

THE BIOCHEMICAL COMPOSITION OF THE LARVAE OF TWO STRAINS OF ARTEMIA SALINA (L.) REARED ON TWO DIFFERENT ALGAL FOODS,
Ghent Rijksuniversiteit (Belgium). Lab. for Biological Research in Environmental Pollution.
C. Claus, F. Benijts, and G. Vandeputte.
Journal of Experimental Marine Biology and Ecology, Vol 36, No 2, p 171-183, January 1979. 1 Fig, 5 Tab, 39 Ref.

Descriptors: *Brine shrimp, *Algae, *Diets, *Growth rates, *Nutrient requirements, Aguiculture, Shrimp, Nutrients, Larval growth stage, Larvae, Metabolism, Animal physiology, Carbohydrates, Biochemistry, Lipids, Proteins, Amino acids, Digestion.

This biochemical culture investigation of effects of feeding Great Salt Lake and San Francisco Bay Artemia nauplii (brine shrimp) for 48 h on a diet of dried Scenedesmus or Spirulina algae confirms that a planktonic organism's biochemical structure and nutritional value is not only genetically determined but is also influenced by physiological age and various environmental factors such as ingested food. Both newly hatched nauplii and larvae starved for 48 h were analyzed as controls. The first instar stage nauplii from Great Salt Lake were significantly larger than those from San Francisco Bay. Larvae of both strains grew faster on Spirulina than on Scenedesmus cells, which is explained by the higher Spirulina protein content (72% compared with 55% Scenedesmus). During 48 h starvation, ash content of the San Francisco Bay larvae doubled (8.17-19.97% body weight), whereas Great Salt Lake larvae increased only 40% (9.52-13.29); carbohydrates and lipids percentage decreased. When larvae were fed, increases in organic content surpassed those in inorganic content, resulting in lower ash content percentages. Starvation results in a relative decrease in some fatty acids such as palmitic, linoleic, and linolenic acids, as others increase (stearic, oleic, and arachidic acids). Major changes occur in fatty acid patterns during fed animals' aging process: Spirulina fed larvae have high levels of linoleic and C20:1 acid, Scenedesmus fed larvae have high levels of C19:1, linolenic acid, and peak 14. (Danovich-Wisconsin)
W80-00502

PHOSPHORUS CYCLING IN ALASKAN COASTAL TUNDRA: A HYPOTHESIS FOR THE REGULATION OF NUTRIENT CYCLING,
Alaska Univ., Fairbanks. Inst. of Arctic Biology.
F. S. Chapin, III, R. J. Barsdate, and D. Barel.
Oikos, Vol 31, No 2, p 189-199, 1978. 4 Fig 2 Tab, 73 Ref.

Descriptors: *Phosphorus, *Cycling nutrients, *Microbial degradation, *Tundra, Alaska, Barrow(AK), Nutrients, Degradation(Decomposition), Balance of nature, Arctic, Soil microorganisms, Soil microbiology, Cold regions, Cycles, Nutrient budgets, Microorganisms, Phosphorus compounds, Organic compounds, Organic soil, Soil profiles, Soils, Soil horizons.

Periodic microbial biomass crashes in Barrow Alaskan wet meadow tundra soil release considerable dissolved inorganic phosphorus for return to the available pool for nutrient cycling. This paper describes an annual budget for phosphorus movement in a wet sedge meadow. The area's growing season is characterized by a four C average air temperature mid-June to late August and continuous solar radiation; tundra soil thaws to 25 cm maximum depth during this time. The system's total nutrient quantity to 20 cm is 19,800 g C sq m and 59.3 g P sq m with 1.3% and 1.3% P in live vegetation. Sixty-four percent of P is organic with 95% of this bound in dead soil organic matter and only 2.2% in live plants and animals. Eighty-four percent of the 21,000 mg sq m inorganic P is non-exchangeable. Only 0.5% of the soil organic P pool turns over each year, giving a residence time of 220 yr. Dissolved inorganic P pools have a net residence time of 10 h. Phosphorus distribution varies strikingly with depth: rapidly circulating pools predominate in upper soils, whereas slowly circulating pools occur more often at depth. Phosphorus input to Barrow tundra is negligible; therefore, the system depends upon internal cycling. Low temperature limits organic matter decomposition, not by its direct effect upon microbial metabolism but rather upon the rates of microbial biomass increases following observed periodic population crashes. (Danovich-Wisconsin)
W80-00503

STRUCTURE AND SUCCESSION IN ROCKY ALGAL COMMUNITIES OF A TEMPERATE INTERTIDAL SYSTEM,
Instituto de Investigaciones Pesqueras, Vigo (Spain).
F. X. Niell.
Journal of Experimental Marine Biology and Ecology, Vol 36, No 2, p 185-200 January 1979 11 Fig, 2 Tab, 25 Ref.

Descriptors: *Intertidal areas, *Succession, *Algae, *Biological communities, Population, Vigo, Spain, Biomass, Competition, Plant populations, Pigments, Ecological distribution, Distribution, Distribution patterns, Plankton, Habitats, Growth rates, Clear-cutting, Growth stages, Life history studies.

The transition from a channelling succession phase to normal structured communities in a intertidal community colonization experiment near Vigo in northwestern Spain is a change in the structure control system. Five algal communities, characterized by the dominance of Pelvetia canaliculata, Fucus spiralis, Himanthalia elongata plus Bifurcaria bifurcata, Himanthalia elongata, and H. elongata, and a red algal pool, were observed October 1974 to October 1975. A second, more accurate observation was only performed in the H. elongata zone October 1975 to January 1977. In cleared surface patterns are regular. Three structured colonization phases are distinguished by opportune diversity measurements; a first colonization phase, followed by a channelling succession (Ulvacean) phase, and a third normal structured community phase. Species numbers increase throughout succession although this number changes seasonally due to physically controlled fixation mechanisms independent of biologically community structure. Biomass increases during the Ulvacean phase, but different change environmental cause considerable monthly fluctutations. Diversity peaks in the overlap between phases and decreased when dominants are abundant. In the colonization phase, chlorophyll values are 300 mg chl-a sq m compared with 1200 mg chl-a sq m in more advanced communities. Pigment diversity, expressed as a ratio of absorption at 430 and 665 nm of methanol extracts, is constant. (Danovich-Wisconsin)
W80-00504

CAN PLANKTOVOROUS FISH KEEP IN CHECK PLANKTONIC CRUSTACEAN POPULATIONS. A TEST OF SIZE-EFFICIENCY HYPOTHESIS IN TYPICAL POLISH LAKES,
Warsaw Univ. (Poland). Chair of Hydrobiology.
Z. Gliwicz, and A. Prejs.
Ekologia Polska, Vol. 25, No. 4, p 567-591, 1977. 9 fig, 3 tab, 61 ref.

Descriptors: *Fish, *Biomass, *Predation, *Crustaceans, *Population, Lakes, Poland, Regression analysis, Mathematical studies, Zooplankton, Smelts, Plankton, Fish food organisms, Food chains, Mortality, Secondary productivity, Competition, Ecology, Fish populations, Aquatic populations.

The effect of planktivorous fish on planktonic Crustacea in mesotrophic and eutrophic Polish lakes is influenced by unspecialized rather than specialized predators, modifying interspecific competition results by favoring presently higher ecologically reproductive species even if these represent competitively weaker forms. The study tested the degree that planktivorous fish predation was

responsible for pelagic zooplankton species composition, seasonal changes, crustacean mortality, and mean crustacean size, in typical central European lakes where main pelagic planktivorous fish are usually vendace, smelt, and bleak. Regression analyses measured the relationship between zooplankton communities structure and predation intensity. Research was done on 30 holomictic lakes June-July 1975 and more detailed work was carried out on eutrophic Lake Mikolajskie (surface 460 ha, max. depth 27.8 m, average depth 11 m) and mesotrophic Lake Taltowisko (surface 327 ha, max. depth 39.5 m, average depth 14 m) 1966-1967 and 1968-1969, respectively. Fish predation is not the main factor responsible for crustacean or cladoceran population elimination. Fish predation is also not considered the essential factor in different average adult sizes, increased mortality, or diminished population reproductivity. Multiple regression analysis results, in which various zooplankton community structure parameters were dependent on many independent variables, show that fish predation rarely elevates coefficient values. (Danovich-Wisconsin)
W80-00505

SURVEY OF SWIMMING POOL ALGAE OF THE PHOENIX, ARIZONA, METROPOLITAN AREA,
Arizona State Univ., Tempe. Dept. of Botany and Microbiology.
R. P. Adamson, and M. R. Sommerfeld.
Journal of Phycology, Vol. 14, No. 4, p 519-521, December 1978. 2 tab, 14 ref.

Descriptors: *Algae, *Chemistry, *Swimming pools, *Phoenix, AR, Arizona, Cyanophyta, Chlorophyta, Chrysophyta, Water chemistry, Physicochemical properties, Habitats, Recreation facilities, Swimming.

Although correlation of physicochemical data with algal species proved futile, this survey identified algal species inhabiting 110 swimming pools in the Phoenix, Arizona metropolitan area. Twenty-four algal species representing four classes were identified. Most belong to Cyanophyta; however, Pleurochloris pyrenoidosa (Xanthophyceae) is dominant, occurring in 67% of the pools. Filamentous cyanophytes, Phormidium and Plectonema are the next most common. Chlorophyta are found in less than 5% of the pools. All Cyanophyceae species and diatom Nitzschia communis are firmly attached to pool surfaces; Pleurochloris pyrenoidosa is loosely attached. Chlorophyceae members are free floating or suspended. In many pools, algal suspensions limit water visibility to a few centimeters. Dominant species in these pools are Oocystis and Chlamydomonas. Algae inhabit swimming pool areas with poor water circulation and particulate matter buildup. Temperature ranges 23-30C, whereas pH and total chlorine are 6.6-9.2 and 0-3.0 mg 1, respectively. Free chlorine levels, a disinfective potential indicator, ranges 0-3.0 mg/l; total hardness is 210-1580 mg CaCO3 1. (Danovich-Wisconsin)
W80-00506

EXPERIMENTAL AND FIELD STUDIES ON ECOLOGICAL ENERGETICS OF ASELLUS AQUATICUS L. (ISOPODA). ENERGY BUDGET OF A POPULATION IN THE LITTORAL ZONE OF POWSINSKIE LAKE,
Polish Academy of Sciences, Warsaw. Dept. of Ecological Bioenergetics.
T. Prus.
Ekologia Polska, Vol 25, No 4, p 593-623, 1977. 7 fig, 8 tab, 32 ref.

Descriptors: *Energy budget, *Productivity, *Regression analysis, *Isopods, Mathematical studies, Energy transfer, Population, Biomass, Respiration, Standing crops, Metabolism, Energy conversion, Energy dissipation, Ecology, Poland.

For three consecutive seasons, 1972-1974, experimental and field studies lasting 176, 217, and 182 days were performed on bioenergetics of Asellus aquaticus, instantaneous and cumulative energy budgets were calculated, and maintenance costs were estimated by predictive and functional methods. Cumulative energy budgets, averaged for three half-year seasons, were: 4.3 kcal sq m (production), 16.3 kcal sq m (maintenance costs), 20.6 kcal sq m (assimilation), 47.5 kcal sq m (unassimilated energy), 68.1 kcal sq m (consumption) according to predictive estimates or 4.3 (production), 14.1 (maintenance costs), 18.4 (assimilation), 42.4 (unassimilated energy), and 60.8 (consumption) kcal sq m functional estimates. Average cumulative gross production efficiency was 6.3% (predictive) or 7.1% (functional) and average cumulative net production efficiency was 21% (predictive) or 23.5% (functional). Cumulative production per season amounted to 6.5 kcal sq m (1972), 4.1 kcal sq m (1973), and 2.8 kcal sq m (1974). Adult: juvenile proportion was relatively constant, 3:2. Cumulative production-to-average biomass ratio ranged 6:1-3.3:1, averging 4.3:1. Cumulative maintenance cost was expressed as the sum of biomass and production respiration. About 67% of population respiratory metabolism was by adults. Energy flow through the population mainly occurs in late spring by May, June and very little energy flow occurs in summer. Asellus aquaticus as an energy recuperator was also discussed. (Danovich-Wisconsin)
W80-00507

THE EFFECT OF INTENSE FERTILIZATION ON MIGRATION OF NITROGEN COMPOUNDS IN SOIL,
Technical Univ. of Warsaw (Poland). Dept. of Sanitary Environmental Engineering.
Z. Szperlinski, and K. Badowska.
Ekolgia Polska, Vol 25, No 4, p 689-702. 1977. 7 fig, 3 tab, 7 ref.

Descriptors: *Ammonium compounds, *Nitrates, *Fertilizers, *Ion transport, *Rainfall intensity, Leaching, Water pollution sources, Nitrogen compounds, Soils, Soil types, Soil chemistry, Poland, Correlation analysis, Soil chemical properties, Rainfall, Water pollution, Path of pollutants, Runoff, Adsorption, Rain, Laboratory tests.

Excessive nitrogen fertilization even at low rainfall results in nitrate accumulation below the root zone; if a long-lasting intense rainfall occurs, nitrate migrates through the soil to pollute groundwater. This laboratory study is concerned with migration dynamics of ammonium and nitrate ion under influence of rainfall in soils fertilized with different amounts of ammonia nitrate, and utilizes loamy silty sand, loamy silt, and light silty clay from near Warsaw, Poland. Soils were fertilized with 200,400, and 600 kg ammonia nitrate/ha and rainfall levels were 20, 40, 60, 80, and 100 mm. Most ammonium ions remained in the 0-6 cm soil level. Ammonium desorption was 5-8 times higher for weak loamy silty sand as compared with light silty clay where-as the ion-exchange capacity ratio of these soils was 1:4.1. In weakly loamy silty sand, ammonium ion desorption due to 80 and 100 mm rainfall was 2.21 and 4.70 kg ammonium ha respectively. Ammonium ions displacement depends upon rainfall rate and soil sorption properties and to a lesser extent, ammonia nitrate concentrations. Nitrate ions migrate gradually; increasing rainfall levels result in nitrate displacement and the disappearance of nitrate peak concentrations in soil layers. Leaching nitrate levels correlates linearly with ammonia nitrate amounts in soil fertilizers. (Danovich-Wisconsin)
W80-00508

THE INFLUENCE OF FERTILIZATION ON PHYTOPLANKTON IN PONDS WITH VARIED DEVELOPMENT OF BIOCOENOSE,
Instytut Rybactwa Srodladowego, Zabieniec (Poland). Dept. of Fish Culture.
M. Januszko.
Ekologia Polska, Vol 25, No 4, P 625-634, 3 fig, 2 tab, 9 ref.

Descriptors: *Fertilization, *Ponds, *Growth rate, *Primary productivity, *Phytoplankton, Biomass, Productivity, Environmental effects, On-site tests, On-site tests, On-site investigations, Poland, Biological community, Nutrients, Ammonia, Algal poisoning, Chlorophyta, Algae, Eco-systems.

This 1974 experiment on seven ponds at the Inland Fisheries Institute, Wilga, Poland, concludes that fertilization effects of phytoplankton depends on biocoenose development stage at the time of fertilizer addition. Nutrients (330 kg/ha urea and 330 kg/ha superphosphate) were introduced in different ponds on three occasions: (1) during weak organism interactions at the onset of young biocoenose seasonal development immediately after pond filling; (2) a month later, when biocoenose development was advanced; and (3) following biocoenose poisoning during community renewal. In type 1, phytoplankton develops fast and maintains a high level; seasonal mean algal numbers were 89,500 cu cm and biomass, 20.8 g cu m. Type 2 fertilization is not favorable for phytoplankton growth. The beginning algal growth level is lower and this limits zooplankton growth; consequently, after fertilizer application, phytoplankton growth is reduced by zooplankton. Mean seasonal numbers and phytoplankton biomass were 19,000 cu cm and 9.4 g cu m, respectively. Two weeks after filling type 3 pond, the biocoenose was poisoned with 1.5 t ha liquid ammonia, killing 96% of the algae However, phytoplankton revived quickly, after five days numbers exceeded those before poisoning. Thus, after toxicity removal, liquid ammonia acts as a fertilizer Mean seasonal numbers were 185,000 cu cm and biomass, 24.5 g u m. In all ponds Chlorophyta is the dominant algae with Chlorella minutissima and Chlamydomonadaceae abundant. (Danovich-Wisconsin)
W80-00509

SIGNIFICANCE OF SORPTION PROPERTIES OF SOILS IN PREDICTING THE MIGRATION OF NITROGEN COMPOUNDS INTO NATURAL WATERS,
Technical Univ. of Warsaw (Poland). Dept. of Sanitary Environmental Engineering.
Z. Szperlinski, and K. Badowska.
Ekologia Polska, Vol 25, No 4, p 675-688. 1977. 11 fig, 2 tab, 15 ref.

Descriptors: *Ammonium compounds, *Nitrates, *Soil types, *Soil chemical properties, *Ion transport, Soils, Pedzols, Brown soils, Clay loam, Nutrient removal, Soil chemistry, Equations, Correlation analysis, Absorption, Adsorption, Fertilizers, Nitrogen compounds, Poland, Biochemistry, Laboratory tests.

This laboratory study on podzolic, black earth, and brown earth soils from around Warsaw and Plock, Poland, describes the role and significance of sorption and desorption soil properties in limiting migration of ammonium ions and nitrate ions from fertilized soils to underground waters due to rainfall. Ammonium desorption under influence of rainfall is only possible with light soils consisting of loose, weakly loamy sands with low ion-exchange capacity (4.0 mval (Ca+Mg)/100 g Dwt soil), clay fraction content (0.002mm), and organic matter content (2%). Ammonium ion desorption levels depend on soil sorption properties. Clay fraction content, ion-exchange capacity, and organic matter are exponentially correlated with ammonium ion desorption. Nitrate desorption under influence of rainfall occurs in all soil types. Desorption levels are limited due to nitrogen assimilation by crops and soil sorption properties. Clay fraction content correlates linearly with nitrate ion desorption. No relation was observed between organic matter content and ion-exchange capacity, and the distribution coefficient K-d or nitrate desorption levels. Equations are given which predict desorption and migration of nitrogen compounds from fertilized soils. Nitrogen ion desorption was examined under dynamic conditions in columns with soil fertilized with 200Kg/ha ammonium nitrate. Distilled water imitating 100 mm rainfall was the desorbing agent. (Danovich-Wisconsin)
W80-00510

METABOLISM OF TOXAPHENE BY AQUATIC SEDIMENT AND A CAMPHOR-DEGRADING PSEUDOMONAD,
Wisconsin Univ.-Madison. Dept. of Entomology
J. M. Clark, and F. Matsumura
Archives of Environmental Contamination and Toxicology, Vol 8, No 3, p 285-298. 1979. 5 Fig, 5

Tab, 20 ref.

Descriptors: *Pesticides, *Microbial degradation, *Pseudomonas, *Chlorinated hydrocarbon, *Lake Mendota, Wisconsin, Toxins, Organic compounds, Degradation(Decomposition), Biochemistry, Microbiology, Microorganisms, Aerobic bacteria, Aerobic conditions, Anaerobic conditions, Sediments, Insecticides, Animal physiology.

Aerobic processes are important in degrading toxaphene, a stable pesticide, in natural aquatic environments. Four aquatic sediment samples were collected from Lake Mendota, Wisconsin, and a bacterial strain, Pseudomonas putida, was selectively screened for its ability to utilize camphor as a sole carbon source. The significance of biologically complex organisms, such as pseudonomads, in pesticide degradation was studied. Degradation in incubated aquatic sediments of 14C-toxaphene proceeded faster under aerobic conditions in contrast to 36C1-toxaphene changed with in anaerobic conditions. Compositions of both 14C- and 36C1-toxaphene changed with reductions of apolar radioactivities and increased in more polar radioactivities at or near the origin. Enriched P. putida cell analysis demonstrated that the toxaphene metabolism aerobic route was more dominant, showing the importance of oxidative metabolism in degradation. P. putida aerobically produced 3.6 times more water-soluble radioactivities when anaerobically cultured. Aerobically incubated 36C1-toxaphene cultures also gave 2.3 times more soluble radioactivities than similarly cultured 14C-toxaphene samples, contrasting sediment experiment results where 36C1-toxaphene readily usable carbon source, more readily degraded 36C1-toxaphene than 14C-toxaphene. (Danovich-Wisconsin)
W80-00511

ALGAL BIOCHEMICAL TRICKS AND CLASSIFICATION,
Hawaii Univ., Honolulu. Sea Grant Coll. Program.
J. W. Hunt.
The American Biology Teacher, Vol 40, No 9, P 528-531. Dec. 1978. 1 Fig, 4 Tab, 6 Ref.

Descriptors: *Algae, *Education, *Cytological studies, *Classification, *Analytical technique, Training, Colleges, Universities, Cyanophyta, Chlorophyta, Rhodophyta, Phaeophyta, Aquatic algae, Marine algae, Plant physiology, Pigments, Plant pigments, Systematics, Biochemistry.

A proposed biology-teaching exercise used alone or with other methods, aids students learning through a discovery of basic algal classification concepts and scientific methods. The exercise utilizes four algal groups with which students most often come in contact: Chlorophyta (green), Cyanophyta (blue-green), Phaeophyta (brown), and Rhodophyta (red) for marine environments; and Chlorophyta and Cyanophyta for fresh-water environments. The main criteria in algal classification are: biochemical characteristics such as (1) nature of food reserves, (2) cell wall components (3) distribution and occurrence of photosynthetic pigments; and (4) structural characteristics, such as the nature of flagella; and (5) unique cellular details. Students may readily investigate biochemical algal characteristics through standard laboratory equipment, reagents, and simple tests, discovering similarities and dissimilarities of algae that suggested the classification scheme. Pigment content is determined through a combination of fat-soluble (acetone, methyl alcohol) or water-soluble pigment extracting agents. A color change of brown seaweed to green in 65 C hot water indicates the presence of fucoxanthin. Cell-wall compisition cause a solution of water and cleaned, dryed, and chopped red or brown seaweed to thicken when it is heated to boiling. Food storage products in Chlorophyta cause a bluish-to-blackish stain when IKI is applied. Other common reagents revealing algal cell structure are aniline blue and HC1. (Danovich-Wisconsin)
W80-00512

REDUCTION OF AQUATIC VEGETATION FOLLOWING THE COLONIZATION OF A NORTHERN SWEDISH LAKE BY THE MUSKRAT, ONDATRA ZIBETHICA,
Umea Univ. (Sweden). Dept. of Ecological Zoology.
K. Danell.
Oecologia, Vol 38, No 1, p 101-106, 1979. 3 Fig, 15 Ref.

Descriptors: *Muskrats, *Environmental effects, *Aquatic plants, *Animal growth, Rooted aquatic plants, Vegetation, Plant populations, Sweden, Lakes, Animal populations, Growth rates, Furbearers, Waterfowl.

Investigation of muskrat (Ondatra zibenthica (L.) impacts on stands of Equisetum, an emergent hydrophyte, in Sladan Lake, northern Sweden, found that mean open water areas per ha Equisetum were 26, 33, and 160 in 1970, 1973, and 1975, respectively. From 1970-1973, low muskrat densities removed one percent of Equisetum stands per year. In the summer of 1975, preceded by two high muskrat density winters, total open water areas increased to four percent. Infra-red photographs were randomly taken July 1970, 1973, and 1975 of 19 Equisetum ha after muskrats first appeared in 1963. Peak muskrat density is 3-6 animals per ha Equisetum. Equisetum standing crop is 0.3 kg Dw sq m and muskrat activity yielded very irregular open water areas. Muskrats influence habitats of dabbling ducks to the greatest extent by increasing edge areas between open water and emergent hydrophytes and increasing open water areas which contain submerged hydrophytes. Muskrats are regarded as a positive factor in waterfowl management. (Danovich-Wisconsin)
W80-00513

THE EFFECTS OF EMERGENCE AND SUBMERGENCE ON THE PHOTOSYNTHESIS AND RESPIRATION OF MARINE MACROPHYTES,
British Columbia Univ., Vancouver. Dept. of Botany.
A. Quadir, P. J. Harrison, and R. E. DeWreede.
Phycologia, Vol 18, No 1, p 83-88, 1979. 3 fig, 1 tab, 23 ref.

Descriptors: *Intertidal areas, *Photosynthesis, *Plant physiology, *Respiration, *Kelps, Dehydration, Tides, Water requirements, Metabolism, Marine algae, Habitats, Environment, Tidal effects, Drying, Canada, Stanley Park, British Columbia.

This study of emergent and submergent effects on gross photosynthesis and respiration rates for three intertidal algae collected in Stanley Park, British Columbia, Canada confirms that net photosynthetic activity is an important factor contributing to algal zonation. Iridaea cordata (low intertidal), Ulva fenestrata (low to mid-intertidal), and Fucus distichus (high intertidal) were collected at 0.9, 1.5, and 3.8 m, respectively, above the Canadian datum point. Evidence that Fucus is well adapted to its high intertidal zone was that net photosynthesis is maximum (6.2 mg CO2 gDw h) 20% dessication; only above 50% dessication does not photosynthesis decrease, and maximum gross photosynthesis, respiration, and net photosynthesis are greater for emerged than submerged thalli. Iridaea is better adapted for submergence than emergence: beyond a small water loss (10%) gross photsynthesis rapidly decreases while respiration stays constant; net photosynthesis reaches peak (4.0 mg C02 gDw h) at 10% dessication and beyond 30-40% dessication it became negative; maximum gross and net photosynthesis for submerged thalli are always greater than when emerged and respiration is less in submergence. Ulva is found between Iridaea and Fucus in the intertidal zone and its response in terms of net photosynthesis to emergence and submergence, is also intermediate when compared to these two algae. (Danovich-Wisconsin)
W80-00514

GROWTH AND COMPETITION OF THE MARINE DIATOMS PHAEODACTYLUM TRICORNUTUM AND THALASSIOSIRA PSEUDONANA, I. NUTRIENT EFFECTS,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
C. F. D'Elia, R. R. L. Guillard, and D. M. Nelson.
Marine Biology, Vol 50, No 4, p 305-312, 1979. 3 fig, 4 tab, 26 ref. N0AA04-6-158-44016.

Descriptors: *Diatoms, *Nutrient requirements, *Silica, *Competition, *Kinetics, Regression analysis, Phosphorus, Nitrogen, Nutrients, Sewage, Marine algae, Growth rates, Productivity, Primary productivity, Sewage effluents, Water types, Limiting factors, Cytological studies.

Batch culture experiments show that Phaeodactylum tricornutum enjoys considerable competitive advantage over Thalassiosira pseudonana in a waste water-seawater mixture not supplemented with silicon. This paper examines competition between T. pseudonana, a small centric diatom which is excellent bivalve food, and P. tricornutum, a small pennate diatom which is poor bivalve food, from nutritional requirements and allelopathic interaction aspects. P. tricornutum monocultures grew at constant, exponential rates (k=1.80) in sewage series for the first five days and final and highest cell densities were 1,930,000-4,450,000 cells ml. T. pseudonana monocultures achieved maximum cell density of 2,180,000 cells ml and grew best in treatments containing added Si. The waste water-seawater mixture had insufficient Si, relative to N and P, for the growth of T. speudonana. Under optimal conditions an estimated N;P:Si atomic ratio of 1:0:12:1 is required by T. pseudonana. P. tricornutum has no demonstrable Si requirement for cell division. No allelopathic interaction between the two species if detectable. In mixed cultures, T. pseudonana grows as rapidly as P. tricornutum in adequate Si supply. This study shows neither species outcompeting the other at k-max; however, outdoor continuous culture dilution rates are considerably less than k-max. (Danovich-Wisconsin)
W80-00515

THE DIATOMFLORA OF A SMALL STREAM NEAR ABISKO (SWEDISH LAPLAND) AND ITS ANNUAL PERIODICITY, JUDGED BY DRIFT AND COLONIZATION,
Umea Univ. (Sweden). Dept. of Biology.
A. Muller-Haeckel, and H. Hakansson.
Archisfur Hydrobiologie, Vol 84, No 2, p 109-217, November 1978. 12 fig, 3 tab, 31 ref.

Descriptors: *Diatoms, *Running waters, *Population, *Distribution, *Cycles, Sweden, Algae, Standing crops, Distribution patterns, Primary productivity, Biorhythms, Streams, Ecological distribution, Environmental effects, Chrysophyta, Plankton, Aquatic drift, Sessile algae.

In-situ sampling of drifting diatoms in Njakojokk stream near Abisko, Sweden, for 250 days from June 1975 to October 1976 demonstrates that diatoms have an innate annual activity pattern with two potential maxima, although environmental factors may modify the pattern. Njakojokk is three km long; water temperature does not exceed 15 C and is 0.1 C for the six coldest months, and water level is high in spring and low in summer and winter. Synedra minuscula, S. tenera, Diatoma elongatum, Meridion circulare, and Tabellaria flocculosa were dominant in plexiglass attachment; Achnanthes minutissima colonized plexiglass slides to a small degree compared with its drift abundance. Diatom colonization maximize annually in May-June and August-September. Synedra species have a high spring maximum and a lower one in August-September. Diatom elongatum have two isolated activity periods, disappearing around the month change in July-August. Annual patterns were more distinct and drifting and colonizing diatom quantities were greater in 1976 than 1975. At different sampling sites Diatoma elongatum showed flexibility in developing one or two maxima during the vegetation period and the highest may be in spring or autumn. (Danovich-Wisconsin)
W80-00516

PHYTOPLANKTON SUCCESSION IN NUTRIENT ENRICHED EXPERIMENTAL PONDS AS RELATED TO CHANGING CARBON, NITROGEN, AND PHOSPHORUS CONDITIONS,
Kansas Univ., Lawrence. Dept. of Botany.
F. DeNoyelles Jr., and W.J. O'Brien.

Archiv fur Hydrobiologie, Vol 84, No 2, p 137-165, November 1978. 6 fig, 5 tab, 48 ref.

Descriptors: *Phytoplankton, *Zooplankton, *Carbon, *Succession, *Nutrient requirements, *Productivity, Chemical analysis, Biomass, Primary productivity, Secondary productivity, Nutrients, Nitrogen,Phosphorus, Cyanophyta, Chrysophyta, Competition, Ecology, Growth rates, Population, Ponds.

Eight experimental ponds at Cornell University, Ithaca, NY studied 1968-1971, demonstrate that nutrient enrichment result in community biomass (222 mg chl a cu m) and productivity (630 mg C cu m/h) increases and in successional changes of the 51 species recorded. Changes in species composition are not only directly related to N and P levels but also to inorganic C availability. In original ponds, Chrysophytes and Cryptophytes such as Chrysochromulina parva, Dinobryon, Uroglenopsis americana, and Cryptomonas dominate. Other rare Chlorophyta and Cyanophta species including Pandorina morum Scenedesmus quadricauda, Sphaero-cystis Schroeteri, and Microcystis aeruginosa rise to dominance as N and P became more available. These species begin to dominate due to several advantages: high maximum growth rates with elevated nutrient concentrations and continued rapid C uptake as increased productivity changes original C availability conditions. Other minor advantages include resistence to grazing, greater buoyancy, and N-fixation. A fertilizer mixture of atomic ratio 22N:2.5P:1K was added at a rate of 53N:13P:6K micro g l d for low nutrient ponds and 281N:70P:32K micro g l d for high nutrient ponds. High nutrient ponds had inorganic N concentrations of 1-2 mg l and reactive P at 500 micro g l. Samples of the 0.1 ha (max. depth 1.22m) ponds were taken weekly spring and summer 1968, bimonthly in summer 1969, and less frequently during recovery phases to summer, 1971. (Danovich-Wisconsin)
W80-00517

PHYTOPLANKTON IN THE COASTAL WATERS OF THE BOTHNIAN BAY OFF KEMI,

Pohjos-Suomen Vesitutkimustoimisto, Oulu (Finland).
E. Alasaarela.

Annales Botanici Fennici, Vol 15, No 4, p 297-308, 1978. 6 fig, 2 tab, 41 ref.

Descriptors: *Phytoplankton, *Primary productivity, *Coasts, *Baltic sea, *Bay of Bothnia, Productivity, Biomass, Nutrients, Effluents, Waste water, Algae, Diatoms, Sewage effluents, Pulp wastes, Water quality, Environmental effects, Finland.

Phytoplankton production maximized late June 1976, along the coastal waters of the Bay of Bothnia in the northern Baltic Sea offshore of Finland and was dominated by Diatoma elongatum. Northern Bothnian Bay is characterized by river water discharges rich in humus but poor in nutrients. The coastal area off the town of Kemi, located at the mouth of Kemijoki River, is heavily influenced by domestic sewage and wood-processing effluents. Phytoplankton and environmental factors were surveyed in 1976. In April, river water with a 0.1% salinity formed a 2-4 m thick layer beneath the ice; salinity below river water was 3.3-3.4%. April oxygen saturation was 7-10 mg 02 1 in surface layers, 1-4 mg 02 1 near the bottom at polluted coasts, and 11-13 mg 02 1 at outermost bottom stations. Highest phosphate concentrations were measured in April, the lowest during summer (early) primary production maximum. Nitrate concentrations are highest in April (100-200 micro g l) and decline rapidly due to phytoplankton consumption after ice break-up. Early summer primary production maximum (104-283 mg C sq m d) occur in late June, a mid-summer minimum (9-18 mg C sq m d) in July, and a late summer maximum (83-210 mg C sq m d) in August. Mean chlorophyll a values are higher near Kemi (2.1-2.8 micro g l) than at outermost stations (1.4 micro g l). Highest values for total biomass occur in polluted areas in July (3.8 mg/l). Annual production was highest near river inflow waters and lowest near acidic and toxic wood-processing mill wastes. (Danovich-Wisconsin)
W80-00518

EFFICACY, UPTAKE AND DISTRIBUTION OF DIFFERENT HERBICIDES IN THE WATER HYACINTH,

Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. for Phytomedicine.
S. P. Singh, and F. Muller.

Weed Research, Vol 19, No 1, p 1-8, February 1979. 2 fig, 3 tab, 10 ref.

Descriptors: *Herbicides, *2,4-D, *Plant physiology, *Pesticide residues, *Water hyacinth, *Aquatic weed control, Pesticide kinetics, Pesticide toxicity, Pesticides, Plant growth regulators, Path of pollutants, Toxins, Persistence, Tracers, Floating plants, Aquatic plants, Water pollution.

Experiments with water hyacinth plants (Eichhornia crassipes) grown in glass-house pots three hours after spraying with 2,4-D, reveals 42.9% of the herbicide on the plants and 53.3% in the water Leaf blades and petioles lying above water receive 32.0% and 9.4%,respectively, and underwater parts, 1.5%. This paper compares behavior of two new herbicides, (asulam and glyphosate) with 2,4-D, studies distribution and persistence of 2,4-D and paraquat in plant-water systems, and investigates the role of roots and underwater plant parts in 2,4-D uptake and translocation. After 14 days, all plants were killed by 2,4-D. The 39.4% herbicide residue was distributed in dead plants (20.5% foliage 9.9% and roots 9.0%), and water (18.9%). Three hours after paraquat spraying 41.1% was present in water and 51.9% in plants (leaf blades 38.9%, petioles above water 8.8%, leaf blades and petioles under water 3.2%, and roots 0.9%). Three days after treatment, paraquat concentration increased in all plant components, underwater foliage doubled and roots trebled compared to the three hour interval. As time increased more herbicide accumulated in underwater parts from paraquat and 2,4-D. Uptake of 2,4-D increased with time, showing that water hyacinths can absorb and translocate the substance from treated water to result in their deaths if concentrations are greater than one ppm. With glyphosate at 2,4 and six kg a.i. ha, all plants were killed within three weeks. Asulam acted very slowly and hampered growth only for a short period at 2-6 kg a.i. ha rates without satisfactory water hyacinth control. (Danovich-Wisconsin)
W80-00519

APPLICATION OF THE AQUATIC MODEL CLEANER TO A STRATIFIED RESERVOIR SYSTEM,

New York State Dept. of Conservation, Albany, Office of Environmental Analysis.
B. Youngberg.

Center for Ecological Modeling Report No. 1, May 1977. 22 p, 34 fig, 1 tab, 25 ref, 2 append. EPA R 8050-47010, 6803-2142, NSF DEB 75-14168 A01.

Descriptors: *Model studies, *Simulation analysis, *Hydrologic data, *Biological properties, *Slapy Reservoir, Czechoslovakia, Nutrients, Biological communities, Reservoirs, Stratification, Epilimnion, Hypolimnion, Testing, Research and development, Computers, Physicochemical properties.

The major weakness of the 'CLEANER' simulation model is that hydrodynamic functions are too oversimplified; however, biological representations are realistic. If CLEANER were coupled to an adequately calibrated physical model, predictions might be more reliable. If sufficient driving-variable and circulation data were more available on several reservoir horizontal sections, the model would yield more realistic simulations. CLEANER is primarily a biological model originally used in completely mixed water systems. This study adapted CLEANER to more common stratified systems. The new CLEANER version uses data from Slapy Reservoir, Czechoslovakia, which is eutrophic, 42 km long, 300 m wide, and has a maximum depth of 53 m. It has been extensively studied for 15 years and data collected between 1959-1960 calibrated the model. The adapted model simulates for epilimnion and hypolimnion layers the following characteristics: phytoplankton, zooplankton, fish, dissolved inorganic nitrogen, phosphate, dissolved and suspended organic matter, dissolved oxygen, and decomposers. Sediment layers are represented by dissolved and particulate organic matter, dissolved inorganic nitrogen, phosphate, decomposers, and zoobenthos. The highest predicted blue-green algal concentration is close to the observed peak although predicted frequent algal oscillations do not actually occur. The model predicts diatom levels fairly well but zooplankton levels poorly. Due to model deficiencies in physical parameters, organism response to ambient conditions is not realistic. (Danovich-Wisconsin)
W80-00520

A MODEL FOR SIMULATING LAKE ECOSYSTEMS,

Rensselaer Polytechnic Inst., Troy, NY. Center for Ecological Modeling.
R. A. Park.

Center for Ecological Modelling, Report no. 3, March 1978, 19 p, 35 fig, 36 ref, 1 append.

Descriptors: *Model studies, *Lakes, *Testing, *Evaluation, Simulation analysis, Ecosystem, Prototype tests, Hydrologic data, Biological properties, Physicochemical properties, Hydraulic models, Research and development, Eutrophication, Projects, Quality control, Estimating.

Seven improvements have been developed for the ecosystem model 'CLEANER': (1) adaptive light and temperature constructs; (2) excess intracellular phytoplankton nutrient submodel; (3) provision for phytoplankton carbon limitation; (4) filter feeding construct refinements; (5) detailed sediment resuspension submodel; (6) light extinction dynamic function; and (7) simultaneous modeling capability for 10 horizontally- and vertically-linked lake segments. CLEANER was adapted to reservoirs, well-stratified lakes, shallow lakes, and high-mountain lakes and its applicability in eutrophication, fisheries management, and thermal pollution was tested. A sensitivity analysis procedure was developed, resulting in greater model evaluation. Nine European lakes were chosen as test sites according to data completeness, diverse lake characteristics, and research team qualifications. Efforts led to the development and verification of the original CLEANER, a comprehensive aquatic ecosystem model. In Slapy Reservoir, Czechoslovakia, the model demonstrates a maximum primary production level beyond which self-shading was limiting. In Loch Leven, Scotland, it suggests phosphate, nitrate, and silica could each be limiting. In several sites it predicts seasonal DO sag in hypolimnion and sediments with corresponding biological effects. It cannot correctly simulate Lake Balaton, Hungary, eutrophication because phosphate removal from marl formation is not modeled. CLEANER should not be applied to fish management problems without further testing. (Danovich-Wisconsin)
W80-00521

MATHEMATICAL MODELING OF PHYTOPLANKTON KINETICS WITH APPLICATION TO TWO ALPINE LAKES,

Rensselaer Polytechnic Inst., Troy, NY. Center for Ecological Modeling.
C. J. Desormeau.

Center for Ecological Modeling Report No. 4, May 1978. 21 p, 27 fig, 102 ref, 1 append. EPA R8050-47010, NSF DEB75-14168 A01.

Descriptors: *Model studies, *Simulation analysis, *Nutrients, *Phytoplankton, *Primary productivity, Lakes, Ecosystem, Testing, Biological properties, Physicochemical properties, Equations, Alpine, Subarctic, Kinetics, Growth rates, Nutrient requirements, Cycling nutrients, Light, Light intensity, Phototropism.

An internal nutrient submodel to 'MS CLEANER', an ecosystem model structured to simulate up to 20 biotic and 20 abiotic-state variables in each of 10 spatial lake segments simultaneously, is formulated to predict phytoplankton growth dynamics. Five process-level formations are incorporated: (1)

external nutrient uptake; (2) growth dependent on internal nutrient concentrations; (3) multiple-nutrient limitation based on threshold hypothesis; (4) light-dependent photorespiration; (5) adaptive light and temperature constructs affecting uptake, assimilation, excretion, respiration and photosynthesis. The phytoplankton growth model includes state-variable equations for phytoplankton, internal nitrogen, internal phosphorus, zooplankton, external nitrogen, and external phosphorus. Liebig's Law of the Minimum describes multiple-nutrient limitation. The model was calibrated for Ovre Heimdalsvatn, Norway, an ultra-oligotrophic, subarctic lake and was validated on Vorderer Finstertaler See, Austria, another ultra-oligotrophic alpine lake but quite dissimilar morphometrically and hydrologically. Vorderer Finstertaler See has a maximum depth of 28.5 m, 15.8 ha area, 2,330,000 cu m volume, and photosynthesis reaches lake bottom due to high water transparency. Ovre Heimdalsvatn has a 13 m maximum depth and 0.778 sq km surface area. (Danovich-Wisconsin)
W80-00522

FORAMINIFERA IN BRACKISH-WATER PONDS DESIGNED FOR WASTE CONTROL AND AQUACULTURE STUDIES IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Geology.
A. LeFurgey, and J. St. Jean, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 105, Price codes: A02 in paper copy, A01 in microfiche. Journal of Foraminiferal Research, Vol. 6, No. 4, p 274-294, October 1976. 11 fig, 5 tab, 59 ref. NOAA 2-35178 and GH-78.

Descriptors: *Sewage effluents, *Protozoa, *Benthic fauna, Eutrophication, Ponds, Plankton, Sewage, Phytoplankton, Effluents, Aquiculture, Habitats, Microorganisms, North Carolina, Distribution, Biomass, Population, Speciation, Standing crops, Environmental effects, Calico Creek(NC), Bogue Sound(NC).

Effluent may not itself be lethal to foraminifera or deleterious to sedimentary environments but effluent in experimental ponds does not favor foraminifera success. This study determines how sewage effluent affects foraminifera species composition and diversity, standing crops, and seasonal and aeral distribution in six artificial ponds on Calico Creek and Bogue Sound, North Carolina. Each 0.1 acre pond with maximum depth less than one m, was constructed and began operation in late 1968; monthly sampling was initiated in fall 1970. Bogue Sound ponds simulate conditions of a well-flushed shallow marine lagoon typical of U.S. mid-Atlantic coast. Calico Creek ponds simulate a shallow marine marsh estuary polluted by secondary effluent discharged from a sewage treatment plant. Elphidium clavatum is the most common species in both effluent and control ponds. Species diversity is 20% higher and average living-foraminifera numbers are five times greater than effluent ponds. Standing crops in effluent ponds average 4.5 living specimens cc, in control ponds 23.7 living specimens cc. Estimated productivity is trebled in control ponds. Microenvironmental differences in oxygen, pH, and food supply make foraminiferal distribution erratic. Moderate summer photoplankton blooms occur in control ponds. In effluent ponds, dense winter phytoplankton blooms and concurrently low light levels, devastate original foraminifera populations, creating fluctuating foraminifera ecological significance. (Danovich-Wisconsin)
W80-00523

TIME SERIES ANALYSIS OF AMMONIA IN THE PASSAIC RIVER,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
T. J. Olenik.
Progress in Water Technology, Vol. 8, No. 4-5, p 237-251, 1977. 6 fig, 6 tab, 9 ref.

Descriptors: *Passaic River(NJ), *Time series analysis, *Ammonia, *Nitrogen, *Statistical models, *Stochastic processes, Rivers, New Jersey, Nutrients, Eutrophication, Algae, Model studies, Water quality standards, Water pollution control, ARIMA model, Methodology, Forecasting, Analytical techniques.

A time series analysis method based on Box and Jenkins (1970), and incorporating the autoregressive integrated moving average model (ARIMA), was used on ammonia-nitrogen data for the Passaic River of northern New Jersey to answer the question of whether or not the ammonia concentration is strictly deterministic or might have additional stochastic characteristics. Water quality and effluent standards have been based on deterministic water quality testing (including waste discharges) and on the resulting mathematical models, but it is becoming increasingly obvious that data and standards should be based on a stochastic model. The 12-month moving average technique used in this study showed somewhat of a long-term trend of ammonia-nitrogen and nitrate-nitrogen data, but there was a great deal of variability. Conclusions: (1) ammonia-nitrogen data analyzed is randomly distributed in time and correlated to some extent in space; (2) lack of fundamental interaction among weekly data shows further the randomness of the data, suggesting also that contributions of upstream treatment plants to ammonia-nitrogen is small; and (3) had there been available distinct daily readings for ammonia-nitrogen the modelling techniques would have been much more effective. At present no significant nitrification or algal growths in the river have been reported, a condition traceable to stream flow characteristics and the lack of direct agricultural runoff. (Lynch-Wisconsin)
W80-00638

A HISTORY OF MERCURY LEVELS IN SWEDISH FAUNA,
Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology.
For primary bibliographic entry see Field 5A.
W80-00649

A SEASONAL SURVEY OF FISH POPULATIONS IN THE LOWER MEDWAY ESTUARY, KENT, BASED ON POWER STATION SCREEN SAMPLES,
City of London Polytechnic (England). Dept. of Biological Sciences.
W. L. F. van den Broek.
Estuarine and Coastal Marine Science, Vol. 9, p 1-15, 1979. 5 fig, 1 tab, 33 ref, append.

Descriptors: *Seasonal, *Fish populations, *Powerplants, *Intakes, Cooling water, Sampling, Dominant organisms, Entrainment, Statistical analysis, Mathematical models, Methodology, Medway Estuary, Kent, England, *Species diversity.

Quantitative samples were collected from the cooling-water intake screens at Kingsnorth Power Station between May 1973 and August 1975. The sampling method is discussed and the catch compared with trawl samples taken in the vicinity. A total of 46,228 fish, 49 species and weighing 325.0 kilograms were taken in 39 screen samples. Numerically the monthly samples were dominated by Sprattus sprattus (L.) and twelve other species which together formed more than 90% of the catch in most months. Short-term fluctuations in catch were marked but superimposed on this was a clear seasonal cycle; numbers of species, numbers of individuals and total weights of catch reached maxima in winter and minima in summer. The three diversity indices measured displayed no definite seasonal pattern, the result of fluctuations in sprat numbers. (Deal-EIS)
W80-00650

THE RESPONSE OF COHO SALMON AND GUPPIES TO 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD) IN WATER,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forestry Sciences Lab.
For primary bibliographic entry see Field 5A.
W80-00651

THERMAL SHOCK RESISTANCE OF SPOT (LEIOSTOMUS XANTHURUS) AFTER ACCLIMATION TO CONSTANT OR CYCLING TEMPERATURE,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
S. I. Hartwell, and D. E. Hoss.
Transactions of the American Fisheries Society, Vol. 108, p 397-400, 1979. 1 fig, 24 ref.

Descriptors: *Heat resistance, *Fish physiology, *Water temperature, Bioassay, Thermal stress, Growth stages, Juvenile growth stage, Mortality, Thermoperiodism, Biorhythms, Lethal limit, *Spot, *Leiostomus.

Postlarval and juvenile spots were acclimated to selected constant temperatures and to diel temperature cycles. Following acclimation they were exposed to temperature shocks from 0 C (control) to 20 C above acclimation temperatures. Twenty-four-hour median lethal shock temperatures (LS50 values) were calculated by probit analysis. The temperature cycles used had no apparent effect on the thermal shock resistance of either postlarval or juvenile spots relative to constant-temperature acclimation. When acclimated at the same temperatures, post-larvae had lower thermal shock resistances than juveniles. Most mortality occurred within 10 minutes of shock onset. (Deal-EIS)
W80-00652

ACCLIMATION TO AMMONIA BY TILAPIA AUREA,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 5A.
W80-00653

GROWTH RATES AND TEMPERATURE SELECTION OF BLUEGILL, LEPOMIS MACROCHIRUS,
Wisconsin Univ.-Madison. Lab. of Limnology.
T. L. Beitinger, and J. J. Magnuson.
Transactions of the American Fisheries Society, Vol. 108, p 378-382, 1979. 1 tab, 44 ref.

Descriptors: *Growth rates, *Thermal stratification, *Sunfishes, Fish diets, Juvenile growth stage, Size, Weight, Fish physiology, Water temperature, Habitats, Fish behavior, Thermal stress, Aquiculture.

Growth rates of individual juvenile bluegills fed 0.75, 2.0, 4.0, and 6.0% dry body weight/day and ad libitum at constant temperatures were smaller above (34 C) than within (30 or 31 C) or below (25 and 28C) this species' preferred temperature range. For each feeding regime growth rate did not differ significantly at temperatures below 34 C. (Deal-EIS)
W80-00654

THE SURVIVAL OF SMOLTS OF SALMON SALMO SALAR L. AT LOW CONCENTRATIONS OF DISSOLVED OXYGEN,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 5A.
W80-00655

TOTAL AND METHYLMERCURY LEVELS IN THREE SPECIES OF WHELKS,
Shimonoseki Univ. of Fisheries (Japan). Dept. of Food Science and Technology.
For primary bibliographic entry see Field 5A.
W80-00656

TRACE METALS IN SEADUCKS OF THE FRASER RIVER DELTA INTERTIDAL AREA, BRITISH COLUMBIA,
Canadian Wildlife Service, Delta (British Columbia).
For primary bibliographic entry see Field 5A.
W80-00657

THE CONCENTRATION AND SPECIATION OF ARSENIC IN MARINE MACRO-ALGAE,
Skidway Inst. of Oceanography, Savannah, GA.

For primary bibliographic entry see Field 5A.
W80-00658

ELECTRIC FISH AS A TOOL FOR WATER QUALITY ASSESSMENT,
City Coll., New York.
For primary bibliographic entry see Field 5A.
W80-00659

SENSITIVITY OF ALASKAN FRESHWATER AND ANADROMOUS FISHES TO PRUDHOE BAY CRUDE OIL AND BENZENE,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
For primary bibliographic entry see Field 5A.
W80-00660

EFFECTS OF BOTTOM SEDIMENTS ON THE SURVIVAL OF ENTEROBACTER AEROGENES IN SEAWATER,
Chinese Univ. of Hong Kong. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-00662

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH-V EFFECTS ON CALCIUM AND INORGANIC PHOSPHORUS EXCRETION IN THE CARP,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W80-00663

EFFECTS OF KUWAIT OILS ON FEEDING RATES OF COPEPODS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 5A.
W80-00666

MEASUREMENT OF COMPLEXING MATERIALS EXCRETED FROM ALGAE AND THEIR ABILITY TO AMELIORATE COPPER TOXICITY,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 5A.
W80-00667

PHOTOOXIDATION PRODUCTS OF A FUEL OIL AND THEIR ANTIMICROBIAL ACTIVITY,
Academy of National Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
For primary bibliographic entry see Field 5B.
W80-00671

NEPHROCALCINOSIS IN RAINBOW TROUT SALMO GAIRDNERI RICHARDSON; THE EFFECT OF EXPOSURE TO ELEVATED CO2 CONCENTRATIONS,
Shearwater Fish Farming Carlisle (England).
For primary bibliographic entry see Field 5A.
W80-00674

HEPATOMAS IN ATLANTIC TOMCOD MICROGADUS TOMCOD (WALBAUM) COLLECTED IN THE HUDSON RIVER ESTUARY IN NEW YORK,
Fish and Wildlife Service, Bozeman MT. Fish Cultural Development.
For primary bibliographic entry see Field 5B.
W80-00675

THE EFFECT OF CADMIUM AND LEAD ON THE GROWTH OF TWO SPECIES OF MARINE PHYTOPLANKTON WITH PARTICULAR REFERENCE TO THE DEVELOPMENT OF TOLERANCE,
Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology.
For primary bibliographic entry see Field 5A.
W80-00676

EFFECTS OF TREATED EFFLUENT ON A NATURAL MARSH,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W80-00677

REDUCTION OF NONIONIC SURFACTANT TOXICITY BY SECONDARY TREATMENT,
Procter and Gamble Co., Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W80-00678

ACUTE TOXICITY OF COPPER, CADMIUM AND ZINC TO THREE SPECIES OF MARINE COPEPOD,
Victoria Ministry for Conservation, Melbourne (Australia). Marine Pollution Studies Group.
For primary bibliographic entry see Field 5A.
W80-00679

UNEXPECTED RESPONSE TO VITAMIN B12 OF DOMINANT CENTRIC DIATOMS FROM THE SPRING BLOOM IN THE GULF OF MAINE (NORTHEAST ATLANTIC OCEAN),
Rhode Island Univ., Kingston. Graduate School of Oceanography.
D. G. Swift, and R. R. L. Guillard.
Journal of Phycology, Vol. 14, No. 4, p 377-386, December 1978. 5 fig, 6 tab, 40 ref. NSF GB 33288

Descriptors: *Diatoms, *Plant physiology, *Growth rates, *Algal growth potential, *Nutrient requirements, Gulf of Maine, Atlantic Ocean, Northeast US, Eutrophication, Plant growth substances, Bioassay, Cycling nutrients, Metabolism, Nutrients, Environmental effects, Biochemistry, Physiological ecology, Laboratory tests, Analytical techniques.

Twelve isolated clones of dominant centric-diatom spring bloom species taken from the Gulf of Maine in April 1968 have no absolute vitamin B12 requirement but respond to B12 in an ecologically significant manner by increased growth rate and decreased lag time. This behavior is inherent in algal physiology and not due to detectable contaminants. Water samples were taken from three stations and enrichment cultures and culture tubes were kept in an illuminated incubator at five C. Genera included were Thalassiosira, Porosira, and Chaetoceros. T. nordenskioelkii, T. rotula, T. aestivalis, and C. concavicornis had higher growth rates with B12 present and reached a bloom population density sooner. T. aestivalis with B12 present showed a 16-day lag and then grew with a 3.4 day doubling time. The vitamin-free culture showed a 30-day lag and 6.3 day doubling time, requiring 54 more days to grow to the bloom density. Some clones removed more than 80% of the vitamin (5 ng B12/l) from the medium. When grown in vitamin-free medium, cells returned 0.01-0.7 ng B12 1 into the medium. Formation of auxospores occurred independently of the presence or absence of B12. The isolated species behaved as B12 auxotrophs with the ability to synthesize their own supply if necessary. The B12 stimulation might allow facultative autotrophic diatoms to compete well with auxotrophic diatoms at the beginning of a bloom. (Danovich-Wisconsin)
W80-00681

THE EFFECT OF ZINC ON THE INCREASE IN LENGTH OF FIVE SPECIES OF INTERTIDAL FUCALES,
Trondheim Univ. (Norway).
For primary bibliographic entry see Field 5B.
W80-00682

THE ROLE OF MELANO-MACROPHAGE CENTRES IN IRON STORAGE IN NORMAL AND DISEASED FISH,
Stirling Univ. (Scotland). Unit of Aquatic Pathobiology.
For primary bibliographic entry see Field 5A.
W80-00683

PHYTOPLANKTON IN THE FOX CHAIN OF LAKES,
Illinois State Water Survey Peoria.
S. D. Lin, R. L. Evans, and D. B. Bruscher.
Water Resource Bulletin, Vol. 15, No. 4, p 974-983, 1979. 3 fig, 2 tab, 10 ref.

Descriptors: *Phytoplankton, *Lakes, *Illinois, *Distribution patterns, Aquatic algae, Water quality, Cyanophyta, Chlorophyta, Diatoms, Dominant organisms, Eutrophication, Aquatic populations, Trophic level, *Flagellates, *Desmids.

As part of a comprehensive water quality investigation on the Fox Chain of Lakes during May to October 1975, water samples from the Chain and Cedar Lake (reference) at 25 locations were collected weekly or bi-weekly to determine the species and densities of algae. The results have been evaluated for algal composition, density, and succession for each location. Sixty-four algal species were recovered from 414 samples. The number of species per sampling location varied from 10 at Channel Lake and Lake Marie to 26 on Fox Lake (main) and Grass Lake. Blue green algae were predominant and occurred at 25 of the 25 sampling stations. They consisted mainly of Aphanizomenon flos-aquae. The only flagellate of importance was Ceratium hirundinella, and significant concentrations of this organism were limited to Channel Lake and Lake Catherine. The only green alga bloom was created by Ulothrix variabilis on the waters of Pistakee Lake. Diatoms were quite significant on the shallower water bodies. (Deal-EIS)
W80-00686

CONCENTRATION AND SOURCES OF FECAL AND ORGANIC POLLUTION IN AN AGRICULTURAL WATERSHED,
Allen County Soil and Water Conservation District, Fort Wayne, IN.
For primary bibliographic entry see Field 5A.
W80-00687

SOME OBSERVATIONS ON POLLUTANTS OF VELSAO BAY (GOA),
National Inst. of Oceanography, Goa (India).
For primary bibliographic entry see Field 5A.
W80-00688

ANALYSIS OF TOXICITY DATA FOR CALIFORNIA MARINE WATER QUALITY STANDARDS,
California State Water Resources Control Board, Sacramento.
L. A. Klapow, and R. H. Lewis.
Journal of the Water Pollution Control Federation, Vol. 51, p 2054-2070, 1979. 6 fig, 2 tab, 19 ref.

Descriptors: *Water quality standards, *California, Water quality control, Ammonia, Toxicity, Chlorine, Heavy metals, Polychlorinated biphenyls, Phenols, Pesticide residues, Chlorinated hydrocarbon pesticides, Sea water, Bioindicators, Chemical wastes, Industrial wastes, Water chemistry, Chemical analysis, Coasts, Bioassays, *Bioaccumulation, *Tissue analysis.

The literature on the toxicity of a number of wastewater constituents toward aquatic life was reviewed and summarized. The constituents included toxicologically important heavy metals, cyanide, phenolics, chlorine, ammonia, chlorinated pesticides, and polychlorinated biphenyls. Reported seawater background concentrations for trace metals and ammonia also were summarized. Estimates were made of acute and chronically toxic thresholds for sensitive aquatic organisms and of average background concentrations of potentially toxic materials that occur naturally in sea water. Concentration estimates were analyzed to yield suitable marine water quality standards. (Deal-EIS)
W80-00689

THE EFFECTS OF POLLUTION-INDUCED OXYGEN DEFICIENCY ON THE BENTHOS IN ELEFSIS BAY, GREECE,
Environmental Pollution Control Project, Athens (Greece).

A. J. Zarkanellas.
Marine Environmental Research, Vol. 2, p 191-207, 1979. 2 tab, 5 fig, 42 ref.

Descriptors: *Seasonal, *Dissolved oxygen, *Benthic fauna, *Sediment, *Diversity indices, Species diversity, Benthos, Distribution patterns, Oxygenation, Sampling, Elefsis Bay(Greece), Oxygen, Water quality, On-site investigations, Water pollution effects, Water pollution sources, Analytical techniques, Industrial wastes, Sewage.

Benthic studies in Elefsis Bay, Greece, have shown pronounced seasonal changes in both numbers of species and of individuals. In both winter and summer, abundance and diversity were higher in the western than in the eastern part of the Bay. In summer, abundance and diversity increased in the former and sharply decreased or dropped to zero in the latter. In summer most of the bottom, with an oxygen concentration of less than 1 ml/litre, became almost azoic. With increasing oxygen concentration the numbers of species and individuals increased. The most abundant and frequent winter species were found in summer in reduced numbers at a limited number of stations, all of which were characterized by an oxygen concentration higher than 1 ml/litre. Dominance diversity (H'), as measured by the Shannon-Werner formula, and its species diversity component (d), showed wide differences both spatially and temporally, which coincided with the dissolved oxygen regimes in the Bay. The evenness component (J') did not seem to be a reliable 'weighting factor' of H' when numbers of species and individuals were low, thus necessitating caution in its use. The values of H', J' and d were compared with those of other areas divided into pollution zones based on purely faunistic data. Using the results of these comparisons, Elefsis Bay was divided into pollution zones which, from two in winter (subnormal and polluted), increased to three in summer when an azoic zone was formed. (Katz-EIS)
W80-00690

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO 1977-1978. VOLUME III: CHEMICAL AND PHYSICAL INVESTIGATIONS.
National Marine Fisheries Service, Galveston, TX. Southeast Fisheries Center.
Annual Report to EPA, September 1979. 710 p. William B. Jackson (Ed). EPA-IAG-D5-E693-EO.

Descriptors: *Water pollution effects, *Oil fields, *Ecosystems, Heavy metals, Environmental effects, Path of pollutants, Model studies, Gulf of Mexico, Pollutant identification, *Outer Continental Shelf, Hydrocarbons, Buccaneer Oil Field.

Volume III of a three volume annual report contains detailed scientific and technical information on the results of chemical and physical investigations of the operating Buccaneer Oil Field off Galveston, Texas. The tasks of the various work units are as follows: To identify and document the extent and types of biological, chemical, and physical alterations in the marine ecosystem that are associated with the development of and production of discharges from an oil field; to describe the fine sediments and nepheloid layer of the oil field, focusing upon their relationship to heavy metal adsorption; to determine levels, pathways, and bioaccumulation of heavy metals; to describe seasonal circulation patterns in the oil field; to determine the specific pollutants, their quantity and effects on the various components of the marine ecosystem; to determine levels, pathways, and bioaccumulation of selected discharge constituents (non-metals) in the marine ecosystem in the oil field; and to construct a hydrocarbon model. (NOAA)
W80-00692

THE IMPACT OF DREDGED HOLES ON OXYGEN DEMAND IN THE LOWER BAY, NEW YORK HARBOR,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 4C.
W80-00694

CHEMICAL POLLUTANTS OF THE NEW YORK BIGHT; PRIORITIES FOR RESEARCH,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
Project Report, June 1979. J. S. O'Conner and H. M. Stanford (Eds.). 227 p, 3 fig, 37 tab, 374 ref, 5 append.

Descriptors: *Water quality, *Water pollution effects, *Pollutant identification, Path of pollutants, Oil pollution, Heavy metals, Chemical analysis, Priorities, New York Bight, Chemical pollutants.

The New York Bight Marine EcoSystems Analysis (MESA) Project of the National Oceanic and Atmospheric Administration (NOAA) is an eight-year interdisciplinary field program involving studies of the New York Bight and of the effects of human influences on this ecosystem. The specific objective of the Project is to determine the fates and effects of contaminants in the New York Bight. The MESA Project sought guidance from a panel of experts to identify the contaminants that are, or may become, the most serious problems in the Bight. This report presents the findings of the investigation. The main text presents the conclusions of the several subpanels, and appendices present detailed data. A single list of references directs the reader to the literature on which the Panel based its findings. The conclusions of the Panel with respect to contaminants of the New York Bight are based on information available in June 1977. The report is intended to encourage other researchers to help quantify the distribution of the contaminants. (NOAA)
W80-00697

A SURVEY OF THE BIOTA, ENVIRONMENT AND USE FOR RECREATION OF TWELVE LAKES IN SNOWDONIA,
University Coll. of North Wales, Bangor. School of Plant Biology.
M. J. Liddle, C. M. Happey-Wood, and A. Buse.
Biological Journal of the Linnean Society, Vol. 11, No. 1, p 77-101, February 1979. 9 fig, 57 ref, 9 append.

Descriptors: *Classification, *Biological communities, *Water chemistry, *Lake morphometry, *Size, Oligotrophy, Invertebrates, Phytoplankton, Water pollution, Recreation, Lakes, Wales, Statistics, Mathematical studies, Lake morphology, Areal, Bioindicators, Physicochemical properties, Indicators, Correlation analysis, United Kingdom.

Twelve lakes intensively used for recreation in Snowdonia, northwestern Wales, were surveyed June and July 1973 to examine possible associations between biota and physical/chemical environments; lake size, as well as chemistry, had important effects on biota. The lakes are all oligotrophic; however, three larger ones contain high nitrogen concentrations. Macrophyte species include Potamogeton natans, Phalaris arundinacea, and Phragmites. Carex rostrata and Isoetes species are always present; Lobelia dortmanna and Litorella uniflora form extensive carpets in some lakes. Phytoplankton species such as Chlamydomonas Grovei, Dinobryon divergens, Ceratium hirundinella, and diatoms Asterionella formosa and Tabellaria flocculosa occur. Larger invertebrates range from chironomid larvae to Limnophilidae. Smaller lakes are associated with three desmids indicator species Arthrodesmus octocornis, Euastrum elegans, and Staurastrum polymorphum while Dinobryon divergens is associated with larger lakes. Principal environmental variables are lake size, conductivity, alkalinity, nitrogen concentration, light extinction coefficients and macrophyte vegetation quantity. Greater emphasis on physical environments, especially lake size, is important when comparing oligotrophic lakes of similar chemistry. If recreation is allowed to increase, biota in smaller lakes would be degraded by pollution such as increasing campers causing increasing sewage, and by mechanical damage to macrophytes by boating. (Danovich-Wisconsin)
W80-00699

A MATHEMATICAL ECOSYSTEM MODEL APPLICABLE TO SHALLOW WATER BODIES,
Deutsche Akademie der Wissenchaften zu Berlin (German D.R.). Inst. fuer Geographie and Geookologie.
For primary bibliographic entry see Field 2L.
W80-00711

A SIMPLE EUTROPHICATION MODEL FOR THE BAY OF KESZTHELY, LAKE BALATON,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 2L.
W80-00712

MODELLING OF THE EUTROPHICATION PROCESS IN LAKES AND RESERVOIRS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 2H.
W80-00718

THE USE OF THE SALINITY MAXIMUM OF THE EQUATORIAL UNDERCURRENT FOR ESTIMATING NUTRIENT ENRICHMENT AND PRIMARY PRODUCTION IN THE GULF OF GUINEA,
Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (Ivory Coast). Centre de Recherches Oceanographiques.
B. Voituriez, and A. Herbland.
Deep-Sea Research, Vol. 26A, No. 1, p 77-83, January 1979. 5 fig, 14 ref.

Descriptors: *Mathematical studies, *Salinity, *Currents(Water), *Nitrates, *Mixing, *Gulf of Guinea, Atlantic Ocean, Nutrients, Primary productivity, Productivity, Chemical stratification, Equations, Oceans, Physical properties, Chemical properties, Water properties, Sea water, Destratification, Water circulation.

Primary production is related to the equatorial undercurrent salinity maximum in the Gulf of Guinea, and because vertical mixing is responsible for equatorial surface enrichment in the Atlantic Ocean, similar relationships between nitrate enrichment, nitracline depth, primary production, and salinity maximum of the undercurrent should be valid for each longitude. This mathematical study presents equations explaining that vertical mixing variations account for summer disappearance of the salinity maximum in the Gulf of Guinea and its strong decrease along the equator from west to east in the summer. Data from cruises of the R.V. Jean Charcot and Capricorne around longitude 4 W from 1973-1977 were used. Production maximum occurs June to September, decreases October to January, and is at minimum in spring. A low nitrate content of 200 mg at sq m is associated with highest observed salinity (36.43%) and undercurrent speed of 100 cm sec, which is unusually high. In tropical areas, primary production is controlled by the nitracline position in the euphotic layer, therefore, nitracline depth is both a measure of light intensity and, indirectly, primary production. The top nitracline depth results from an equilibrium of physical processes such as vertical advection and mixing, and nitrate uptake by phytoplankton. Thickness of the nitrate depleted layer is defined by depth of the maximum stability layer through which little nitrate diffuses and in turn indicates the amount of vertical mixing. (Danovich-Wisconsin)
W80-00781

A MORPHOMETRIC STUDY OF LEAD AND COPPER EFFECTS ON DIATOMA TENUE VAR. ELONGATUM (BACILLARIOPHYTA),
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5A.
W80-00782

COMPARISON OF ANESTHETIC POTENCY OF BENZOCAINE HYDROCHLORIDE AND

MS-222 IN TWO FRESHWATER FISH SPECIES,
Randse Afrikaanse Univ., Johannesburg (South Africa). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00784

TOXICITY OF FISHERY CHEMICALS TO THE ASIATIC CLAM, CORBICULA MANILENSIS,
Fish and Wildlife Service, Warm Springs, GA. Southeastern Fish Control.
For primary bibliographic entry see Field 5A.
W80-00785

CARBONIC ACID ANESTHESIA FOR AQUATIC ORGANISMS,
Colorado State Univ., Fort Collins. Dept. of Fishery and Wildlife Biology.
For primary bibliographic entry see Field 5A.
W80-00786

INTERACTIVE EFFECTS OF SALINITY, TEMPERATURE AND POLYCYCLIC AROMATIC HYDROCARBONS ON THE SURVIVAL AND DEVELOPMENT RATE OF LARVAE OF THE MUD CRAB RHITHROPANOPEUS HARRISII,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-00790

RESPONSES OF MARINE FOULING COMMUNITIES TO SEWAGE ABATEMENT IN KANEOHE BAY, OAHU, HAWAII,
Research Corporation of the University of Hawaii, Honolulu.
For primary bibliographic entry see Field 5B.
W80-00791

EFFECTS OF ARTIFICIAL EUTROPHICATION ON THE METABOLISM OF THE JAPANESE OYSTER CRASSOSTREA GIGAS,
Tohoku Univ., Sendai (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5B.
W80-00792

THE ROCK OYSTER SACCOSTREA GLOMERATA AS AN INDICATOR OF TRACE METALS IN HONG KONG,
Fisheries Research Station, Aberdeen (Hong Kong).
For primary bibliographic entry see Field 5A.
W80-00793

THE USE OF CHIRONOMID PUPAL EXUVIAE IN THE SURVEILLANCE OF SEWAGE POLLUTION WITHIN A DRAINAGE SYSTEM,
Bristol Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00794

CHRONIC TOXICITY OF VANADIUM TO FLAGFISH,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00795

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5A.
W80-00796

TOXIC EFFECTS OF AQUEOUS EXTRACTS OF EKOFISK CRUDE OIL, CRUDE OIL FRACTIONS, AND COMMERCIAL OIL PRODUCTS ON THE DEVELOPMENT OF SEA URCHIN EGGS,
Tromoe Univ. (Norway). Inst. of Biology and Geology.
For primary bibliographic entry see Field 5A.
W80-00798

THE EFFECTS OF CHANNELIZATION ON FURBEARERS AND FURBEARER HABITAT,
Mississippi State Univ., Mississippi State.
M. H. Gray, and D. H. Arner.
Proceedings of the Thirty-First Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Vol. 31, p 259-265, 1977. 7 tab, 7 ref.

Descriptors: *Channel improvement, *Habitats, *Furbearers, Channeling, Beavers, Minks, Muskrats, Dominant organisms, Animal populations, Stream improvement, Wildlife habitats, Luxapalila River, Mississippi, Alabama.

Biological data were collected over a 3 year period (1974-1977) from an old channelized segment (55 years), an unchannelized segment and a newly channelized segment (4 years) of the Luxapalila River in Mississippi and Alabama. This study revealed that furbearer habitat in the channelized segments has not recovered to the level exhibited in the unchannelized segment. Indices of furbearer abundance were obtained by night lighting and sign counting. Beaver (Castor canadensis), mink (Mustela vison), muskrat (Ondatra zibethicus), and raccoon (Procyon lotor) were more numerous in the unchannelized segment than in either the old or newly channelized segments. (Deal-EIS)
W80-00800

5D. Waste Treatment Processes

DRINKING WATER SUPPLY - A FIELD FOR UNICEF ASSISTANCE.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, Pergamon Press, 1978. Vol. 1, part 2, p 847-856.

Descriptors: *United Nations Children's Fund, *Water resources development, *Sanitation, *Water supply, *Financing, *Potable water, Grants, United Nations, Rainwater, Wells, Stream, Springs, Water sources, Social participation, Training, Public health, Developing countries, Groundwater, Education.

Safe water and sanitation at the village level is basic to all maternal and child health work, and has a direct bearing of child morbidity and mortality and on the economic and social welfare of the community. UNICEF provides assistance for installation of wells, gravity systems, and related needs, and emphasizes training, integration of health education and water supply schemes, community participation in all phases of a project, and planning for subsequent operation and maintenance. Some 10-15% of total UNICEF allocations are spent on water supply and sanitation (US $13.5 million in 1975). Over 80 of 112 countries in which UNICEF is active currently receive such aid. Projects range from pilot or demonstration projects to substantial contributions to large government programs. Groundwater is usually tapped through dug or drilled wells; the latter are preferred in terms of sanitation and speed. Mountain streams and capped springs are a source of water in parts of Asia and Africa, and some areas with no other water resources make use of rainwater catchments. Pilot villager education projects have been funded in India, UNICEF assistance takes the form of equipment, materials, and funds. The government is usually expected to make a significant contribution to the project, and to assume responsibility for maintenance. (Lynch-Wisconsin)
W80-00420

MAIN TRENDS IN TREATMENT OF MUNICIPAL AND INDUSTRIAL SEWAGE IN THE USSR,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
S. A. Schubert, S. V. Yakovlev, and I. Y. Rubchak.
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2163-2178

Descriptors: *Soviet Union, *Sewage treatment, *Industrial wastes, *Municipal wastes, *Methodology, *Waste water treatment, Sludge treatment, Water pollution control, Governments, Recycling, Biological treatment, Chemical treatment, Water purification, Reagents, Flotation, Hyperfiltration, Filtration, Desalinization, Ion exchange, Oxidation, Chlorine, Ozone, Flocculation, Organic matter, Sorption.

Biological treatment is the predominant traditional Soviet treatment method for municipal and most industrial sewage containing organic contaminants in dissolved and colloidal states. Research is underway on use of biological agents to intensify treatment, employing symbiotic sludge structures, specific microorganisms, biochemical stimulants, and mutagenesis. Pretreatment improvements involving forced separation of slurries include open and pressure hydrocyclones and bowl centrifuges Post-treatment facilities are used to supplement biological treatment at municipal purification plants and at certain large industrial enterprises For both municipal and industrial sewage treatment local and central facilities are combined to ensure technological and economic optimization. Chemical treatments commonly include reagents and flocculants. Flotation and hyperfiltration are also used to extract contaminants from sewage; hyperfiltration, electrodialysis and ion exchange are used for desalinization. Extensive use is made of filters. Complete removal of dissolved organic matter from sewage is effected by sorption on powdered and granular sorbents. Among physicochemical methods, oxidative processes with active chlorine, chlorine dioxide, and ozone, and important. Sludge treatment typically includes concentration, stabilization of the organic portion, conditioning, dehydration, and product use or waste disposal. (Lynch-Wisconsin)
W80-00464

MICROBIOLOGICAL WATER QUALITY IN RELATION TO PUBLIC HEALTH,
Department of Health, Pretoria (South Africa)
For primary bibliographic entry see Field 3C.
W80-00482

EFFECTIVENESS OF SAND FILTERS FOR BACTERIOPHAGE ESCHERICHIA COLI T1 REMOVAL USING CALCIUM AS AN AID.
Auburn Univ., AL. Dept. of Civil Engineering
S. R. Jenkins, and J. L. Barton.
In: Chemistry of Wastewater Technology, p 99-110, 1978. Ann Arbor Science Publishers, Inc. Ann Arbor, Michigan. OWRT A-064-ALA(2), 14-34-0001-9001.

Descriptors: *Virus, Water treatment, Calcium, Sand filters, *Bacteriophages, Wastewater treatment, Escherichia coli.

The investigation dealt with enhancing the effectiveness of sand filtration processes for virus removal. Since filtration processes are common to both wastewater and water treatment, a better understanding of virus removal mechanisms and the effect of filter aids on this removal is of interest in both areas. In particular, this research investigates the effectiveness of model and sand filters for removal of Escherichia coli T1 phage when calcium is used as a chemical conditioner. Although the flowrate passing through the filters was more representative of those found in tertiary treatment of wastewater.
W80-00493

INDIVIDUAL NON-URBAN WASTEWATER TREATMENT AND MANAGEMENT ALTERNATIVES: TASK B: SUMMARY OF ALTERNATIVE ON-SITE WASTEWATER TREATMENT AND DISPOSAL METHODS, REGION J, N.C.
Triangle J Council of Governments, Research Tri-

angle Park, NC.
November 1978. 99 p. PO-04099-01-08.

Descriptors: *Septic tanks, *Wastewater treatment, *Wastewater disposal, *Water quality management(Applied), *Triangle J Region(NC), Waste water, Waste disposal, Water quality, Disposal, Sewage disposal, Discharge, *Waste treatment.

The overall purpose of Task B is to provide easy access to information on a wide variety of alternatives for on-site treatment and disposal of wastewater for the Triangle J, N.C. region. The options range from simple modifications of the conventional septic tank/soil absorption system to more complex and innovative methods of on-site treatment. The authors see the use of septic tank systems as substantially increasing in the Region and therefore stress the options for proper collection, handling, treatment and disposal of septage. The effectiveness of septic tank systems is dependent on the proper flow of wastewater through the system and the avoidance of hydraulic overload. Therefore, water conservation practices and methods are important and those suggested include greywater reuse, dual flush toilets and flow constricting devices on faucets and shower heads. In those areas which cannot support septic systems due to restrictive soils or population density the authors emphasize cluster systems where there is sewage collection from groups of homes or small communities into a larger septic tank or directly into a central waste treatment facility. Brief comments on costs are included for most individual options. (Iervolino-NC)
W80-00534

ENVIRONMENTAL POLLUTION CONTROL ALTERNATIVES: MUNICIPAL WASTEWATER,
Culp/Wesner/Culp, El Dorado Hills, CA.
G. Culp.
Prepared for U.S. Environmental Protection Agency, Technology Transfer, Report No. EPA-625/5-76-012, May 1976. 79 p.

Descriptors: *Waste water treatment, *Municipal wastes, *Sewage treatment, *Effluents, *Oxidation, *Activated sludge, *Sludge, *Sludge treatment, Environmental sanitation, Water pollution, Advanced waste treatment, Primary treatment, Secondary treatment, Trickling filters, Waste disposal, Sludge disposal, Aeration, Organic wastes, Biochemical oxygen demand, Chemical oxygen demand.

This study delineates the potential treatment methods for sludge waste from municipal wastewater. Most of the impurities removed from wastewater are in the form of solids, leaving a residue called 'sludge'. Advanced treatment removes between 95% and 99% of the final impurities, but results in the remaining sludge wastewater. Current wastewater treatment methods--primary, secondary and advanced--are discussed, with advantages and disadvantages, costs, energy and space requirements presented. Five steps for handling and disposing of sludge resulting from treatment are presented: (1) conditioning the sludge with chemicals or heat so that water may be readily separated; (2) thickening--removal of more water by gravity or flotation; (3) dewatering--further separation of water by subjecting the sludge to vacuum pressure; (4) stabilization of the organic solids so that they may be safely handled; and (5) the reduction of solids to a stable form by wet oxidation processes or incineration. Alternatives for wastewater treatment and handling of sludge must consider factors such as current effluent and space requirements, the nature of the raw wastes, air pollution effects, safety considerations, costs, resource consumption, economic and environmental effects of sludge production, and reliability of the process selected. (Arnold-NC)
W80-00544

ANALYSIS OF OPERATIONS AND MAINTENANCE COSTS FOR MUNICIPAL WASTEWATER TREATMENT SYSTEMS,
Dames and Moore Water Pollution Control Engineering Services, Denver, CO.
For primary bibliographic entry see Field 6B.
W80-00549

5E. Ultimate Disposal Of Wastes

MAIN TRENDS IN TREATMENT OF MUNICIPAL AND INDUSTRIAL SEWAGE IN THE USSR,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
For primary bibliographic entry see Field 5D.
W80-00464

POTENTIAL GROUND WATER POLLUTION FROM SEWAGE SLUDGE APPLICATION ON AGRICULTURAL LAND,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5G.
W80-00489

INTEGRATION OF RESIDUAL WASTE MANAGEMENT WITH WATER QUALITY MANAGEMENT,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 6E.
W80-00526

LONG-TERM EFFECTS OF LAND APPLICATION OF DOMESTIC WASTEWATER: VINELAND, NEW JERSEY, RAPID INFILTRATION SITE,
Benham-Blair and Affiliates, Inc., Oklahoma City, OK.
E. L. Koerner, and D. A. Haws.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 501, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA-600/2-79-072, March 1979. 167 p, 11 fig, 27 tab. 68-03-2363.

Descriptors: *Domestic wastewater, *Rapid infiltration systems, *Effluents, *Primary effluent, *Groundwater pollution, *Land treatment, *Vineland(NJ), Wastewater, Infiltration, Groundwater, Evaluation, Analysis, Wastewater disposal, Groundwater recharge, Soil properties, Trace elements, Water chemistry, Wastewater treatment, Municipal wastes.

This report presents the findings of a study on the long-term effects of applying treated domestic wastewater to an infiltration site at Vineland, NJ. Using a high rate, rapid infiltration method, primary treated domestic wastewater has been applied to three separate infiltration basins for approximately 50, 29 and 3 years, respectively. To evaluate the effects water and soil samples taken from the test site were compared with similar samples taken from a control site that was upstream and did not receive any wastewater. Sample analyses included metals, nutrients, organics, bacteria and viruses. In the effluent applied to Basin I mean concentrations of 18 of the 48 parameters analyzed statistically were found to be significantly greater than in the control groundwater. Sixteen of the eighteen parameters were found to be significantly greater in the test site groundwater below Basin I than in control groundwater. In the effluent applied to Basins II and III differences in 20 mean concentrations out of the 48 analyzed parameters were found to be greater than in the control groundwater. Mean concentrations for 17 and 13 parameters for test groundwater below Basins II and III, respectively, were found to be significantly greater than concentrations in the control groundwater. (Iervolino-NC)
W80-00529

ENVIRONMENTAL POLLUTION CONTROL ALTERNATIVES: MUNICIPAL WASTEWATER,
Culp/Wesner/Culp, El Dorado Hills, CA.
For primary bibliographic entry see Field 5D.
W80-00544

TRANSPORT OF VIRUSES THROUGH ORGANIC SOILS AND SEDIMENTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Scineces.
P. R. Scheuerman, G. Bitton, A. R. Overman, and G. E. Gifford.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No. EE4, Proceedings Paper 14756, p 629-640, August 1979. 8 fig, 2 tab, 14 ref, 1 appendix. NSF ENV73-07823 A02.

Descriptors: *Viruses, *Sewage effluents, *Waste water disposal, Soils, Organic soils, Humus, Organic matter, Soil texture, Humic acids, Hydrogen ion concentration, Leaching, Sediments, Laboratory tests, Land application, Virus transport.

A black organic sediment (15.5% organic carbon) retained only 60% and 75% of virus suspended in secondary effluent and groundwater, respectively. When some of the water-soluble 'humic materials' were leached from the sediment, the sorptive capacity was increased. Further investigation of the interfering capacity of these humic substances revealed that they interfere significantly with the adsorption capacity of poliovirus to a sandy soil. The addition of CaCl2 to humic solutions was shown to restore the sorptive capacity of the soil. Molecular weight fractionation by ultrafiltration showed that the decrease in virus adsorption is due to fractions with a molecular weight below 50,000. An organic muck soil (45.4% organic carbon) was found to retain 92% and 82% of the applied virus suspended in groundwater and sewage effluent, respectively. It was concluded that organic soils are not particularly suitable for the application of sewage effluent. (Sims-ISWS)
W80-00584

RECHARGE TO LOW-LEVEL RADIOACTIVE-WASTE BURIAL TRENCHES 11 THROUGH 14, WEST VALLEY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
D. E. Prudic.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225. Microfiche $3.50, paper copy $1.00. Geological Survey open-file report 79-990, 1979. 5 p, 1 fig, 2 ref.

Descriptors: *Radioactive waste disposal, *Underground waste disposal, *Infiltration, Groundwater recharge, Clays, Cements, Cracks, Water level fluctuations, *West Valley(NY), Burial trenches, Trench cover.

After the dry summer of 1978, water levels began to rise in four of seven newer low-level radioactive-waste burial trenches at the Western New York Nuclear Service Center. The water-level rise in these trenches does not appear to be related to ground-water inflow, but rather to increased infiltration of precipitation through the clay-rich till cover over the trenches. The increase in infiltration is attributed to inflow through cracks caused by dessication and (or) settling of the buried refuse (Woodard-USGS)
W80-00775

5F. Water Treatment and Quality Alteration

DRINKING WATER SUPPLY - A FIELD FOR UNICEF ASSISTANCE.
For primary bibliographic entry see Field 5D.
W80-00420

REPORT ON COMMUNITY WATER SUPPLIES,
World Health Organization, Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference;

Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, Part 3, p 971-992.

Descriptors: *Water supply development, *Developing countries, *Water resources development, *Sewage disposal, *Sanitation, *Planning, *Potable water, Domestic water, HABITAT, World Health Organization, United Nations, International cooperation, Water policy, Manpower, Governments, Priorities, Financing, Institutional constraints, Rural arreas, Public relations, Social participation.

An action strategy for developing community water supply and waste disposal programs in developing countries was submitted to the 1977 United Nations Water Conference by the World Health Organization. The report was prompted by conclusions of HABITAT, the United Nations Conference on Human Settlements held in 1976, which stated that: (1) nearly two-thirds of the populations of developing countries lack a safe and ample water supply, and even more do not have hygienic waste disposal facilities; and (2) these needs should be given top priority in all nations, and qualitative and quantitative goals should be set. These targets require drastic measures and firm commitments. Global action should include: (1) promoting increased awareness of the problem; (2) setting a target date of 1990, with priority given to the less-privileged; and (3) allocation of a larger proportion of total resources for economic and social development to water supply and sanitation Each country should: (1) develop national plans and programs for community water supply and waste disposal geared to the 1990 target date, (2) also set intermediate goals, (3) initiate engineering and feasibility studies, (4) assess manpower needs and establish training programs, (5) conduct public opinion campaigns, (6) establish appropriate institutions, and (7) develop a national financing system. The international community should: (1) increase financial contributions, (2) cooperate in planning, and (3) intensify monitoring and reporting efforts. (Lynch-Wisconsin)
W80-00427

ON WATER REUSE PROMOTION MEASURES,
Ministry of International Trade and Industry, Tokyo (Japan).
For primary bibliographic entry see Field 6F.
W80-00477

EFFECTIVENESS OF SAND FILTERS FOR BACTERIOPHAGE ESCHERICHIA COLI T1 REMOVAL USING CALCIUM AS AN AID,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W80-00493

IMPLEMENTATION STRATEGIES FOR PUBLIC LAW 92-500, SECTION 208,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 6E.
W80-00524

INTEGRATION OF RESIDUAL WASTE MANAGEMENT WITH WATER QUALITY MANAGEMENT,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 6E.
W80-00526

LONG-TERM EFFECTS OF LAND APPLICATION OF DOMESTIC WASTEWATER: VINELAND, NEW JERSEY, RAPID INFILTRATION SITE,
Benham-Blair and Affiliates, Inc., Oklahoma City, OK.
For primary bibliographic entry see Field 5E.
W80-00529

ENVIRONMENTAL POLLUTION CONTROL ALTERNATIVES: MUNICIPAL WASTEWATER,
Culp/Wesner/Culp, El Dorado Hills, CA.
For primary bibliographic entry see Field 5D.
W80-00544

WASTEWATER AS A SOURCE OF NUTRIENTS AND WATER FOR HYDROPONIC CROP PRODUCTION IN ARID REGIONS,
California Univ., Los Angeles; and American Univ., Beirut (Lebanon), and Alexandria Univ. (Egypt).
A. Wallace, S. M. Soufi, and A. M. El Gazzar.
Advances in Desert and Arid Land Technology and Development, v. 1, Adli Bishay and Wm. G. McGinnies, eds. Harwood Academic Publishers 1979, p 263-270, 1 fig, 9 ref.

Descriptors: *Water reuse, *Recycling, *Municipal wastes, *Hydroponics, Reclaimed water, Cultures, Crop production, Urban hydrology, Greenhouses, Cycling nutrients, Nutrient requirements, Aquatic productivity.

An online hydroponic culture system is described and discussed here as a means of recycling urban wastewaters in underdeveloped arid regions. An initial pilot plant plastic greenhouse 9.2 sq. m constructed at the Tapia Plant of the Las Virgenes Municipal Water District in Los Angeles County, California, has shown that reclaimed water from a sewage plant at Calabasas, California was, with the exception of iron, a satisfactory source of nutrients for growing crop plants in hydroponic culture under pilot plant commercial conditions. A generalized scheme for the use of hydroponic plant growth procedures in wastewater treatment processes is illustrated in which crop plants deplete or strip nutrients from the water making it more suitable for the next stage of water renovation, which could even be additional hydroponic culture. The wastewater can be used for irrigation at various stages or it can have other domestic or urban uses. It is concluded that while the pilot project described here demonstrated that commercial horticultural crops could be grown using municipal wastewater as the source of nutrients and water, the limits of many important cultural parameters have not yet been determined. (Tickes-Arizona)
W80-00642

5G. Water Quality Control

SWEDISH POLICY FOR WATER QUALITY PROTECTION,
National Swedish Environment Protection Board, Stockholm
For primary bibliographic entry see Field 6E.
W80-00454

TOXIC SUBSTANCES IN WATER--THE U.S. EXPERIENCE.
Environmental Protection Agency, Washington, DC.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2017-2034.

Descriptors: *United States, *Water pollution control, *Poisons, *Water pollution sources, *Chemicals, *Industrial wastes, Bioaccumulation, Environmental protection agency, Carcinogens, Public health, Human diseases, Regulation, Water quality standards, Effluent limitations, Water pollution effects, Radioisotopes, Radioactive wastes, Metals, Organic compounds, Legislation, Federal Toxic Substances Control Act, Federal Water Pollution Control Act, Amendments of 1972, Policy, Pesticides, Effluents, Methodology, Governments.

Measures adopted by the United States for controlling industrial discharge of toxic substances are described. Of special concern are metals, metallic compounds, synthetic organic compounds, and ionizing radiation. Chemicals which particularly threaten man are lead, cadmium, cadmium sulfate, kepone, carbon tetrachloride, chlorinated phenols, ethylene glycol, asbestos, beryllium, dioxin, and mercury. Toxic substances are major carcinogens, and highest cancer rates occur in areas of most concentrated industrial chemical use and activity. Introduction of toxic substances is controlled in the U.S. mainly by: (1) regulation of products and their uses, and (2) regulation of industrial effluents. The former is accomplished by reducing inputs of the toxic material or finding a substitute, the latter by altering the production process or through treatment. Effluent guidelines, water quality standards, and pretreatment and toxic substances restriction have been combined by the Environmental Protection Agency into an integrated, flexible, and technology-related strategy for control of toxic substances. Special restrictions were placed on aldrin/dieldrin, DDT (DDD, DDE), endrin, toxaphene, benzidine, and PCBs. Appendices to this report present a summary of the Toxic Substances Control Act of 1976, a list of specified pollutants, industrial point source categories, decay characteristics of transuranic nuclides, and evaluation and testing procedures. (Lynch-Wisconsin)
W80-00456

DETERIORATION OF WATER QUALITY DUE TO LONG RANGE TRANSPORT OF AIR POLLUTION,
A. Tollan, and B. Hagerhall.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2059-2070.

Descriptors: *Acid precipitation, *Air pollution, *International cooperation, *Water pollution sources, *Airborne transport, *Scandinavia, Sweden, Norway, United States, Canada, Europe, Industrial wastes, Path of pollutants, Hydrogen ion concentration, Acidic water, Precipitation(Atmospheric), Sulfur, Nitrogen, Lakes, Rivers, Fish, Forests, Environmental effects, Dry deposition, Fossil fuels.

Increased acid precipitation is the main cause of extensive losses of salmonid fish stocks and other fish populations in southern Scandinavia, northeastern United States, and southeastern Canada. In addition, airborne transport of sulfur compounds are a threat to forest ecosystems and productivity, and to human health. Extensive surveys conducted in Sweden and Norway have documented adverse effects of the transport of pollutants through the atmosphere, and research has indicated that the major source of acid precipitation in Scandinavia is the combustion of fossil fuels in the heavily industrialized parts of Europe. Highly acid precipitation in a central area of Europe as early as the 1960s had a pH of 3-4, and the area is growing steadily larger. All governments should reduce emissions of pollutants to the air. The Governments of Norway and Sweden have prohibited use of heavy oil containing over 1% sulfur. World efforts to monitor and evaluate long-range transmissions of air pollutants across national frontiers must be intensified, and data collection should be integrated in the United Nation's Global Environmental Monitoring System. The present policy in some countries of dispersing harmful pollutants by means of tall stacks is no longer acceptable. International cooperation in reducing air pollutant emissions is needed. (Lynch-Wisconsin)
W80-00458

METHODS OF GROUND-WATER PROTECTION FROM POLLUTION.
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 4B
W80-00463

POLLUTION CONTROL IN THE MINING INDUSTRY IN SOUTH AFRICA,
R. T. Rudd
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 4, p 2583-2600.

Descriptors: *South Africa, *Water pollution control, *Mine wastes, *Water pollution sources, *Mining, Gold mines, Coal mines, Water shortage,

Arid lands, Bafokeng Mine(South Africa), Coal mine wastes, Slime, Mine water, Mine drainage, Waste dumps, Dams, Legislation, Regulation, Industrial wastes.

Mine-related water pollution in South Africa is discussed, including causes, control measures, specific problems of gold and coal mines and mines containing toxic material, and the 1974 Bafokeng disaster. Regulations of the 1956 water act and regional standards for industrial effluents are given. Mining may cause water pollution because of: (1) disturbance of soluble material which pollutes water pumped from the mine, (2) leaching of materials such as chlorides from nonmined geological strata, (3) chemicals used in mining (e.g., nitrates formed by blasting), (4) bacteriological pollution from human contact or excreta, (5) solids from dumps, (6) chemical reaction of normally innocuous material upon exposure to the air, and (7) erosion of rocks causing suspended sediment loading of waters. Pollution control is based on: (1) water use limitation, (2) containment or isolation of specific polluting elements such as slimes dams or reduction works, (3) effluent quality control and safe disposal of substrandard effluent, and (4) limiting the scope of unavoidable pollution and minimizing effects. All mines are required to: (1) economize water use, (2) prevent entry of storm water, (3) dispose of underground water according to regulations, (4) build polluting facilities at sites away from water sources, and (5) purify and safely dipose of or reuse effluents. At the Bafokeng platinum mine a slimes dam breach killed several people, caused a fishkill, and spread slimes over a large area. (Lynch-Wisconsin)
W80-00484

POTENTIAL GROUND WATER POLLUTION FROM SEWAGE SLUDGE APPLICATION ON AGRICULTURAL LAND,
Connecticut Univ., Storrs. Inst. of Water Resources.
R. W. Wengel, and G. F. Griffin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-10297, Price codes: A02 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1979. 17 p, 10 tab. OWRT A-074-CONN(1). 14-31-0001-6007.

Descriptors: *Sewage sludge, *Land application, *Groundwater pollution, Nitrates, Heavy metals, Leaching, Soil nitrates, Corn silage, Zinc, Copper, Cadmium, Lead, Nickel.

Corn for silage was grown for three years on land treated with either annual applications or a single application of limed, dewatered sewage sludge at six rates of application; 0, 13, 33, 66, 99 and 132 metric tons per hectare, dry weight. Yields of silage, heavy metal uptake, soil heavy metals, soil nitrates and soil pH were measured. Soil pH increased under all sludge applications in proportion to rate and total amount of sludge applied. At the highest rate of application, soil pH of the surface layer was 7.7 and 7.2 for annual and single applications, respectively. High soil pH reduced extractability of soil metals and also crop uptake of zinc. Soil Cd, Cu, Ni, Pb and Zn increased with sludge application rate only in the plow layer. No leaching of these metals occurred. Soil nitrates increased with sludge application rate. Leaching and accumulation of nitrates at depths of 244 cm were shown at high application rates. Soil nitrates and soil pH were two factors that would limit sludge application rates in this study. Residual nutrients from sludge suggest best management to be decreasing rates of sludge application over the three year period of application. (de Lara-Conn)
W80-00489

IMPACTS OF A LARGE RECREATIONAL DEVELOPMENT ON WATER QUALITY IN A SEMI-PRIMITIVE ENVIRONMENT,
Montana State Univ., Bozeman. Inst. of Applied Research.
For primary bibliographic entry see Field 5C.
W80-00498

URBAN STORMWATER POLLUTION: AN INVESTIGATION OF THE PROBLEM AND ITS CONTROL,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 5B.
W80-00525

INDIVIDUAL NON-URBAN WASTEWATER TREATMENT AND MANAGEMENT ALTERNATIVES: TASK B: SUMMARY OF ALTERNATIVE ON-SITE WASTEWATER TREATMENT AND DISPOSAL METHODS, REGION J, N.C.
Triangle J Council of Governments, Research Triangle Park, NC.
For primary bibliographic entry see Field 5D.
W80-00534

CHEMICAL POLLUTANTS OF THE NEW YORK BIGHT; PRIORITIES FOR RESEARCH,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
For primary bibliographic entry see Field 5C.
W80-00697

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

RESOURCES AND NEEDS: ASSESSMENT OF THE WORLD WATER SITUATION,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata; Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 1, p 1-45.

Descriptors: *Water management(Applied), *Water supply, *Water resources development, *Basic data collections, *Water demand, Adoption of practices, Forecasting, Projections, Research priorities, Water policy, United Nations Water Conference, Water distribution(Applied), Water shortage, Management.

The worldwide supply of water is a fixed quantity and 97.3% of it is ocean water not readily useable for domestic, industrial or irrigation purposes without desalination. Most current projections on a global scale show accelerating future demands on this finite stock, and gross water demand has already exceeded water supplies in some places. But instead of assuming that current demand-supply patterns must necessarily persist, it is more useful to examine alternative and approved water conservation techniques through which policy makers might rationalize water consumption habits so as not to outstrip supplies. But to accomplish this, ways must be found to implement effective and socially acceptable management procedures for water demand before the need to use them is dictated by the timing of worldwide water shortages. Other global water management problems: (1) For much of the world, basic data is inadequate for water supplies and their rational use. (2) Because of large present margins of error in the data base, water management decisions are beset by uncertainty and inaccurate forecasting. (3) The gap between scientific knowledge and its application is widening in most parts of the world. The most urgent water management need is not that of devising new administrative methods but of utilizing technology and institutional schemes which are available now. (Harris-Wisconsin)
W80-00401

THE PROMISE OF TECHNOLOGY: POTENTIAL AND LIMITATIONS, PART ONE,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 1, p 47-69.

Descriptors: *Water management(Applied), *Technology, *Water supply, *Water demand, *Industries, United Nations Water Conference, Methodology, Water users, Water resources development, Institutional constraints, Economics, Costs, Political aspects.

Considerations of technological options for water resources management (WRM) must also focus on technologies of numerous activities with linkages to and impacts upon the water supply. Basic considerations include implementation incentives and institutional arrangements, societal objectives and constraints, current economic dynamics, water demand-supply gross variations, local spatial infrastructure, projected operations, and maintenance problems, associated inputs such as energy and land, productivity and other process application effects, incremental costs, and returns per unit of water supply, and relationship of technological options to each of several water resource system components. WRM technologies fall in three categories: (1) physical-engineering technologies; (2) computational-analytical technologies; and (3) production technologies external to the WRM system but affecting it. The range of options includes exploration and assessment of water resources, development of new sources, direct improvement of water body assimilative capacity, water transport, on-site water utilization, WRM systems planning and operation, and non-conventional options. Choice criteria are: complexity, dependability, flexibility, timing, labor availability, cost, related non-human inputs, cost-effectiveness, accessibility to users, availability of associated inputs, management organization, use of local materials, relation to other projects, side effects, accuracy of estimates, and political considerations. (Harris-Wisconsin)
W80-00402

THE PROMISE OF TECHNOLOGY: POTENTIAL AND LIMITATIONS. PART TWO,
World Meteorological Organization, Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 1, p 71-112.

Descriptors: *Water management(Applied), *Technology, *Water supply, *Irrigation, *Water resources development, *Waste water treatment, United Nations Water Conference, Irrigation efficiency, Water supply, Waste water disposal, Remote sensing, Satellites(Artificial), Data transmission, Nuclear moisture meters, Groundwater, Groundwater recharge, Erosion control, Sediment control, Forecasting, Model studies, Computer models, Flood control, Weather modification, Artificial precipitation, Evaporation control, Desalination.

Three general areas in which technological backup can be applied to worldwide water resources management problems are discussed: (1) technologies for assessment and enhancement of water resources; (2) improving efficiency of water use in agriculture; and (3) technology in community water supply and waste water disposal. Developing countries may benefit to a varying degree from any or all of 10 kinds of modern technology for water resources management: remote sensing and satellites for data transmission; nuclear waste assessment techniques; groundwater assessment and enhancement; erosion and sedimentation control; improved forecasting methods; modelling and computers; flood management; weather modification, especially induced precipitation; evaporation suppression; and desalination. Agricultural water use can be improved through efficient forest and range management; rain water harvesting; management of water bodies; land use planning; control of land degradation caused by water erosion, sedimentation, flooding, waterlogging and salinity; management in irrigation; control and metering devices for water distribution; and conjunctive use of differing water sources. Important issues affecting water supply and wastewater technology include: source development and protection; water purification and quality control; transportation, storage and distribution of water; collection of waste water; and waste water treatment. (Harris-Wisconsin)
W80-00403

POLICY OPTIONS,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 1, p 113-152.

Descriptors: *Water management(Applied), *Water resources development, *Water policy, Water allocation(Policy), United Nations Water Conferences, Non-structural alternatives, Water law, Water rights, Regulation, Planning, Land use, Water demand, Forecasting, River basin development, Legislation, Pollution taxes(Charges), Water rates, Water distribution(Applied), Water supplies, Municipal water, Domestic water, Water pollution control, Industrial wastes.

The rationale, objectives, main overall options and sectoral options for developing a worldwide policy for water resources management are discussed. While no single policy option is best suited for all times and places, a judicious blend of structural and non-structural measures for policy development will be based on the following considerations: (1) Compilation of complete inventories of existing water resources and water rights. (2) Coordination of planning for both the land and water resources of any given region. (3) Determination of water demand by successive approximations of various sectors of the economy on a basin or regional basis. (4) Physical forecasting and warning services to be applied especially in areas where droughts and floods regularly recur. (5) Consolidation of regional water agencies and their coordination by national planning bodies. (6) Enactment of comprehensive water legislation to replace or complement sectoral legislation. (7) Adoption of user fees and charges for water supply and effluent systems. (8) Water law for agriculture that shall insure coordinated distribution of water supply by an agency at geographically and administratively appropriate levels of governmental authority. (9) Legal and regulatory provision to assure adequate water supplies for domestic and municipal use and to regulate consumption and disposal of effluent at reasonable cost. (10) Adequate pollution control as a supplement to regularized water distribution for the industrial sector. (Harris-Wisconsin)
W80-00404

PRESENT AND FUTURE ACTIVITIES OF THE UNITED NATIONS SYSTEM IN WATER RESOURCES DEVELOPMENT.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 1, p 153-271.

Descriptors: *United Nations Water Conference, *Water management(Applied), *Water resources development, *International cooperation, *Institutions, Food and Agricultural Organization, International Development Organization, World Health Organization, Childrens Education Fund(UNICEF), UN Environmental Program, UN Development Program, International Atomic Energy Agency, World Bank.

Program proposals are given for improving the capacity of the UN to serve water resources management needs of developing countries more effectively and on a layer scale than in the past. Roles and general objectives of UN agencies involved in water resources development are described. Agencies included are: Food and Agricultural Organization, International Development Organization, World Health Organization, Children's Educational Fund (UNICEF), UN Environmental Program, UN Development Program, International Atomic Energy Agency, and World Bank. Present water resource-related activities of these organizations are analyzed; indication is given of how these activities might develop in the future, particularly in light of the worldwide goals being proposed at the United Nations Water Conference of 1977. General UN institutional problems for water resources management are discussed, including program coverage impact for individual agencies and problems of effective evaluation of ongoing activities. Constraints and inter-program institutional reinforcement are discussed. Two recommendations are made to the 1977 UN Water Conference: (1) A proposed Interagency Water Resources Board would have membership from among all international agencies with water-related programs. The board would coordinate all such programs, provide technical assistance at the inter-secretariate level, provide direct technical help to member states, and perform other advisory services. (2) Because of regional variances among water resources and water-related problems, the mandate of various UN regional commissions should be strengthened in the area of water resources management. (Harris-Wisconsin)
W80-00405

REPORT OF THE ESCAP REGIONAL PREPARATORY MEETING FOR THE UNITED NATIONS WATER CONFERENCE.
Economic and Social Commission for Asia and the Pacific (UN), Bangkok (Thailand).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 371-418.

Descriptors: *Economic and Social Commission for Asia and the Pacific, *United Nations Water Conference, *Regional planning, *Asia, *Pacific Ocean, *Water supply, International commissions, United Nations, Water demand, Planning, Priorities, Water resources development, Policy, Governments, Water law, Administration, Institutions, Water pollution control, International waters, Water resources.

The report to the United Nations Water Conference at Mar del Plata, Argentina in March 1977 by the U.N. Economic and Social Commission for Asia and the Pacific (ESCAP) is presented, together with the deliberation of the regional commission at a preparatory meeting at Bangkok, Thailand July-August 1976. ESCAP met to assess water supply and demand problems of member countries, to identify important issues and constraints affecting national water programs, and to draft the report to the Water Conference. Summaries of country reports are included. The report submitted to the conference includes two sections: (1) background information based on chiefly the country reports, and (2) matters requiring attention for achieving water supply and management goals, with recommendations for action. The first section deals with total water resources, supply and demand and water quality. The second section discusses: (1) institutions and policies, (2) water law and administration, (3) the relationship between land management and water resources, (4) domestic vs. imported expertise, (5) basic data gathering, (6) water resources assessment (stream discharge, available water, water quality), (7) water use (including changes in water quality), and (8) water management (water regulation, distribution, use, and quality), and (9) special issues (rural water supply, mitigation of flood and drought loss, desalination, weather modification, evaporation suppression, aquifer recharge, remote sensing, international rivers, education, and research management). (Lynch-Wisconsin)
W80-00406

REPORT OF THE REGIONAL PREPARATORY MEETING OF THE COUNTRIES OF LATIN AMERICA AND THE CARIBBEAN FOR THE UNITED NATIONS WATER CONFERENCE,
Economic Commission for Latin America (UN), Mexico City.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 419-466.

Descriptors: *United Nations Water Conference, *Latin America, *Regional planning, *Economic Commission for Latin America, *Water resources development, United Nations, Water resources, South America, Central America, Planning, Panama Canal Zone, International commissions, Governments, Water law, International law, Sovereignty, Water utilization.

The United Nations Economic Commission for Latin America met in Lima, Peru, August-September 1976 preparatory to the United Nations Water Conference at Mar del Plata, Argentina, March, 1977. Summaries are given of statements by member countries on their major water resources development problems, plus statements by several intergovernmental and nongovernmental organizations (FAO, UNESCO, WHO/PASB, IRBD, WMO, UNICEF, UNEP, UNDP, OAS, IDB, and AIDA.) Based on country reports submitted prior to the meeting, a preliminary draft of the ECLA Regional Report to the Water Conference, 'The Water Resources of Latin America', was prepared and subsequently revised at the meeting. The final version is published elsewhere in this volume. Country summaries are given here for Argentina, Ecuador, Jamaica, Dominican Republic, Chile, Colombia, Bolivia, Venezuela, Paraguay, Panama, Cuba, Mexico, Peru, Honduras, Uruguay, Guyana, Antigua and Barbuda, Nicaragua, Guatemala, El Salvador, and Haiti. (Lynch-Wisconsin)
W80-00407

ECONOMIC COMMISSION FOR EUROPE. REGIONAL REPORT,
Economic Commission for Europe (UN), Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 2, p 467-518. 12 tab.

Descriptors: *Water management(Applied), *Economic Commission for Europe, *Europe, *United Nations Water Conference, *Water resources development, *Regional planning, International commissions, Water resources, United Nations, International waters, Lakes, Water supply, Water demand, Planning, Governments, Aquifers, Water sources, Irrigation, Water pollution control, Expenditures, Institutions, Administration, International agreements, Policy, Social participation.

A regional report to the United Nations Water Conference at Mar del Plata, Argentina, March 1977 by the Economic Commission for Europe (ECE) reviews water problems and water management in the 33 member nations. Conclusions: (1) though the overall quantity of water available in most ECE countries is fully sufficient until the year 2000, it is usually not adequate in the place needed or at the time of greatest demand; (2) pollution has reduced the amount of usable water; (3) water policies have been aimed at structural, efficiency, and water quality measures; (4) actual water use is far below potential use; (5) future demand is expected to increase 3.9% annually to 1980 and 2.9% thereafter; (6) investments in water resources development range 0.29-2.04% GNP; (7) water supply costs will rise; (8) comprehensive planning is underway in many countries using models and automation; (9) public participation in development is increasing; (10) resistance to structural measures (dams and reservoirs) is growing; (11) demands for environmental protection are increasing; (12) most governments consider current pollution legislation adequate; (13) there is a trend toward centralized water management; and (14) economic incentives and charges are commonly used. (Lynch-Wisconsin)
W80-00408

ECONOMIC COMMISSION FOR AFRICA, REGIONAL REPORT,
Economic Commission for Africa (UN), Addis Ababa (Ethiopia).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 519-638. 8 fig.

Descriptors: *Africa, *Economic Commission for Africa, *United Nations Water Conference, *Water resources development, *River basins, *Water supply, *Regional planning, United Nations, Water demand, Water utilization, Energy, Data collections, Water balance, Desalination, Water pollution control, International commissions, Water resources, International waters, Governments, Planning, Institutions, Training, Policy.

The regional report to the United Nations Water Conference at Mar del Plata, Argentina, March 1977 by the Economic Commission for Africa contains an introductory section, followed by a section on principle matters requiring attention in the area of water resources development in the 34 member countries. Problems include: (1) assessment of water availability (surface water, groundwater, and nonconventional sources such as desalination); (2) utilization and development of water resources; (3) present level of utilization; (4) demand projection; (5) drought; (6) planning; (7) policy issues (policy formulation, technology, water pollution, legislation, international river basin development); and (8) major constraints (capital, manpower training, institutional problems). African water resources are characterized by relative scarcity and uneven distribution. Water availability per unit area is the lowest of the continents and the coefficient of evaporation is the highest. Water pollution is principally a result of sewage and industrial effluents. Acute capital scarcity is a major impediment to effective development of available water resources, as is a critical shortage of trained personnel and training programs. Institutions responsible for water resources development need streamlining, and effective mechanisms for coordination of effort at the national level need to be provided. (Lynch-Wisconsin)
W80-00409

REPORT OF THE ECONOMIC COMMISSION FOR WESTERN ASIA REGIONAL PREPARATORY MEETING.
Economic Commission for Western Asia (UN), Beirut (Lebanon).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 639-658.

Descriptors: *Middle East, *United Nations Water Conference, *Economic Commission for Western Asia, *Water resources development, *Regional planning, International commissions, Desalination, United Nations, Water demand, Water supply, Water pollution control, Water resources, Governments, Planning, Policy, Arid lands, Groundwater recharge, Aquifers.

The regional report to the United Nations Water Conference at Mar del Plata, Argentina, March 1977 by the Economic Commission for Western Asia includes an account of the preparatory meeting of the ECWA held at Baghdad, Iraq, December 1976. At the meeting brief country reports were given, statements were made by UNEP, WHO, Council of Arab Economic Unity, and Arab Fund for Economic and Social Development, and a draft of the regional report was revised. Members of ECWA are Bahrain, Democratic Yemen, Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Yemen Arab Republic, and United Arab Emirates. The report contains: (1) physical features and meteorology, (2) an assessment of water resources and needs, (3) technology, and (4) policy options. Most of the region falls into the arid and semiarid zones, typified by the Arabian Peninsula where few areas receive over 100 mm average rainfall, and many receive none at all. There is a critical shortage of data on meteorology, hydrology, and water use in most areas. Water demand is increasing for municipal, industrial, and rural domestic use, while agricultural demand is increasing in some areas but has stabilized in others. Seawater desalination has been a major water source for 30 years. The potential for groundwater recharge is vast, and has been applied on a limited scale. Most of the countries lack a clearly defined water policy, and water pollution control, especially in coastal and marine areas, needs serious attention. There is an acute need for trained manpower. (Lynch-Wisconsin)
W80-00410

SOCIO-ECONOMIC ASPECTS OF URBAN WATER RESOURCES PLANNING AND MANAGEMENT,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 685-698.

Descriptors: *Planning, *Urban hydrology, *Urban sociology, *Water resources development, *Water management(Applied), *Water supply, *Waste disposal, Municipal wastes, Social aspects, Decision making, Developing countries, Costs, Urbanization, Water demand, Social needs, Multiple-purpose projects, Water reuse, Municipal water, Economics, Hydrology, Solid wastes, Sewage disposal, Groundwater.

Conclusions and recommendations of a workshop on Socio-Economic Aspects of Urban Hydrology held at Lund, Sweden in November 1976 are presented, as well as material from the report of the 1973 UNESCO workshop on Hydrological Effects of Urbanization held at Warsaw, Poland. The paper focuses on: (1) the role of water in urban society, (2) multipurpose planning, and (3) urban planning and development as a function of water availability. The most important water-related urban problem is the interrelationship of augmented water demand and waste disposal. In addition, solid waste disposal in dumps and sanitary landfills often severely pollutes groundwater and, through leaching, surface water. Present knowledge of the relationship between urban hydrology and socio-economic factors is inadequate. Urban water management and planning, and decision-making processes, are social in nature and result from complex interactions of: (1) needs, (2) type of development, (3) organizational capability of institutions, (4) urban social structure and community types, and (5) values, attitudes, and goals of planners, workers, administrators, and residents. Resolving urban water problems requires a holistic approach to analysis of the water system's component subsystems, such as water demand, water supply, sewage disposal, etc. A feedback monitoring system is needed to control the three basic functions of time, space, and quality. Planning should consider welfare, social well-being, and quality of life. Project evaluation and liaison are discussed. (Lynch-Wisconsin)
W80-00413

THE WATER RESOURCES OF LATIN AMERICA REGIONAL REPORT,
Economic Commission for Latin America (UN), New York.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, Part 2, p 721-790.

Descriptors: *Latin America, *Water resources development, *United Nations Water Conference, *Regional planning, *Water supply, *Water demand, River basins, South America, Central America, United Nations, Economic Commission for Latin America, Data collections, Water resources, Electric power generation, Hydroelectric power, Planning, Policy, Technology, Water pollution control.

The regional report of the Economic Commission for Latin America (ECLA) to the United Nations Water Conference at Mar del Plata, Argentina, March 1977 describes the area's water resources. Contents: (1) water supply and uses, (2) technological potential and limitations, and (3) policy options. Though Latin America has the most abundant water resources in the world, there are also arid areas and rapid demographic and economic growth has greatly increased water requirements. Waterborne diseases remain a problem, and water pollution is growing increasingly serious. During 1961-1970, 4% of gross investment was allocated to water development projects, possibly reaching 5% 1971-1980. Future investment will probably be allocated 50% to hydroelectric projects, 30% to urban water supply and sewage, and 20% to irrigation, drainage, flood control, and other purposes. Industrial water consumption (including thermal power stations) could increase 350% by the year 2000. Hydroelectric water demand is the use increasing most rapidly in the region, with power generation increasing 9% per yr. Several areas of acute water shortages are listed. Policy options are discussed under: (1) legislation and institutions, (2) planning, (3) sectoral strategies (water supply and sewerage, agriculture irrigation, flood plains), (4) industry and mining, (5) nonconsumptive water use, (6) financial questions, (7) technological development, (8) environmental and health considerations, (9) extreme situations, and (10) shared basins. (Lynch-Wisconsin)
W80-00415

WATER, WOMEN, AND DEVELOPMENT,
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 791-810.

Descriptors: *Women, *Water resources development, *Economic development, *Rural areas, *Developing countries, *Labor, *Manpower, Employment, Water supply, Public health, Solar energy, Groundwater, Water conservation, Planning, Africa, Asia, Latin America, Water carrying, Rural sociology, Crop production, Foods, Resource allocation.

The often-overlooked role of women in developing countries is intimately related to rural water technology development. Identifying the needs of rural women may clarify developmental problems and provide a valuable index for measuring progress in rural development. In many cases, water supply can become the focus of integrated rural development projects, since it supports multisectoral developments in health, food production, land use, employment, and education. Women provide 60-80% of agricultural labor in Africa and Asia, and 40% in Latin America. Water carrying, mostly done by women, requires a great amount of work time and may consume 12-25% of daily caloric needs. Water-related health dangers strongly affect women in their roles as mothers and principle caretakers of family health. Water development projects offer important employment opportunities in rural areas, and benefits to women should be carefully evaluated. Water-related technology can serve as a catalyst for incorporating women into agro-industries and other semirural industries brought into being by water availability. Special measures are needed to guarantee women equal access to training and employment. Increasing the water supply can reduce the need for water carrying and reduce health problems, thus permitting women more time for food production and other occupations. Water conservation may be the most economical means of increasing water supply, along with groundwater pumping by solar or diesel power. An appendix considers application of solar energy. (Lynch-Wisconsin)
W80-00416

BASIC NEEDS STRATEGY AND WATER RESOURCES POLICY,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 815-818.

Descriptors: *Policy, *Water resources development, *Basic needs, *Labor-intensive, *Potable water, *Resource allocation, Foods, Industries, Water resources, Developing countries, Rural areas, Domestic water, Planning, Economic development, Poverty, Irrigation, Hydroelectric power, Agriculture, Public works.

The importance of emphasizing basic human needs in economic development policy, rather than simply maximizing growth of gross domestic product, has been increasingly recognized at both national and international levels. This paper examines this strategy as applied to water resources development, specifically regarding: (1) water for drinking and domestic use, (2) water for food, (3) water and rural industrialization, and (4) water and jobs. Basic needs are limited here to material needs, which include food, clothing, shelter, employment, and public services. Regarding domestic water supply, water resources development policy should focus on rural areas where water supply systems are primitive, rather than on improving water supply in urban areas where services already exist, and programs should be geared to lower income groups. Food production policy should be

directed toward mobilizing skills and energy of rural inhabitants for water projects of agricultural water supply, deemphasizing imported capital-intensive technology. Irrigation schemes should be planned in the contest of the system of rural institutions, and of integrated rural development. Small-scale hydroelectric projects may be best-suited to developing countries with scarce foreign exchange. Employment should be generated in public works related to water supply, utilizing labor-intensive methods whenever possible in irrigation, drainage, flood control, small-scale surface water works (and parts of large scale projects), and tube wells. (Lynch-Wisconsin)
W80-00418

WORLD EMPLOYMENT PROGRAMME: APPROPRIATE CONSTRUCTION TECHNOLOGY FOR WATER CONTROL AND IRRIGATION WORKS IN DEVELOPING COUNTRIES,
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 819-846.

Descriptors: *Developing countries, *Labor intensive, *Water resources development, *Construction, *Analytical techniques, *Employment, *Manpower, Labor, Economic development, Technology, Irrigation, Administration, Institutional constraints, International cooperation, India, Philippines, Sharavathi Valley(India), Pasig River(Philippines), Sharavathi Valley(India), Pasig River(Philippines), Research priorities, Planning, Resource allocation.

With mass unemployment a very serious problem in developing countries, efficient labor-intensive construction methods should be used in water resources development projects at all appropriate stages from planning to implementation. This 'appropriate construction technology,' is analyzed in five sections: (1) scope of labor-intensive techniques, (2) criteria for the choice of appropriate technology, (3) planning and implementation issues, (4) role of international cooperation, and (5) recommendations for future research. Recent field studies by the U.N. International Labor Office of the Sharavathi Valley earthworks project, India, and the Pasig River flood control levee construction, Philippines, demonstrated labor-intensive methods to be as cheap as, or cheaper, than equipment-intensive methods, and the great potential for increasing productivity by improving existing methods or introducing new ones. Use of the proper tools and implements is essential for effective use of labor-intensive techniques; such tools can often be made locally. Factors to be considered in technology selection include: (1) equipment-intensive methods do not always produce the shortest construction time, and (2) a continuous supply of labor is not guaranteed even in a labor-surplus economy. Use of labor-intensive methods requires modification of organizational structures and administrative procedures. Multi-national firms, tied-aid arrangements, and international aid agencies are partially responsible for the trend to equipment-rather than labor-intensive technology. (Lynch-Wisconsin)
W80-00419

TECHNICAL COOPERATION AMONG DEVELOPING COUNTRIES WITH REGARD TO WATER RESOURCES DEVELOPMENT.
For primary bibliographic entry see Field 6E.
W80-00425

ASSESSMENT OF WATER RESOURCES: NETWORKS, SURVEYS, SERVICES, AND RELATED FACILITIES: PRESENT STATUS AND REQUIREMENTS BY 2000.
World Meteorological Organization, Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York 1978, Pergamon Press. Vol. 1, part 3, p 953-970.

Descriptors: *Water resources, *Assessments, *Developing countries, *Surface waters, *Groundwater, *Manpower, *Costs, Wter supply, Water resources development, Inventories, Networks, Surveys, Scientific personnel, Hydrology, Technology, Asia, Pacific Ocean, Latin America, Africa, Europe, International cooperation, Financing.

Estimates are given of monetary and manpower requirements of all developing countries (by region) for minimum assessment of their water resources by the year 2000. Water resources management and development is impossible without assessing quantity and quality of available water, but many developing countries lack minimum capability to carry out such a continuing inventory. Of the total investment of $1.3 trillion needed for data collection network development to bring surface water resources assessment to a minimum, 85% pertains to Africa and South America. By region, surface water costs are $710 million for Africa, $199 million for Asia and the Pacific (excluding China and the U.S.S.R.), $396 million for Latin America, and $5 million for Europe. The total for groundwater assessment is $7.7 trillion, $2.8 trillion in Africa, $1.4 trillion in Asia and the Pacific, $3 trillion in Latin America, and $470 million in Europe. Total world manpower requirements for surface water assessment are 1040 professionals, 4700 technicians, and 42,000 observers; for these three groups, the figures for Africa are 550, 2500, and 22,500 respectively; for Asia and the Pacific 160, 750, and 6300; and for Latin America 330, 1450, and 13,200. For groundwater assessment a total of 2465 professionals and 9600 mid-level technicians are needed, 960 and 4000 in Africa, 575 and 3000 Asia and the Pacific, and 930 and 2600 Latin America. Use of national personnel is highly recommended, but will require extensive training facilities. Increased national efforts will assist international cooperative efforts. (Lynch-Wisconsin)
W80-00426

INTERNATIONAL RIVER BASIN CO-OPERATION: THE LESSONS FROM EXPERIENCE,
British Columbia Univ. Vancouver. Westwater Research Centre.
I. K. Fox, and D. G. LeMarquand.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata; Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 3, p 1041-1062.

Descriptors: River Basin development, *International waters, *International cooperation, *Treaties, *Regional development, Rivers, River basins, Water resources development, Institutions, Political constraints, Riparian rights, Planning, Regional planning, Pilcomayo River(South America), Mono River(Africa), Niger River, Senegal River, Columbia River, Vardar-Axios River Basin, Nile River, Indus River, Zambesi River, Rhine River Basin, Water management(Applied).

A report on international river basin cooperation, is based on nine basins and one case of regional cooperation. Conclusions: (1) nations sharing a river must be willing to cooperate in its use; (2) management schemes and their consequences must be fully understood by all parties, which requires strong national water organizations; (3) river basin organizations and procedures for exchanging data and resolving technical differences, can be of invaluable assistance; and (4) a consensus on legal principles to govern resources development and use is important since in many cases an economic incentive does not exist to negotiate an efficient and equitable agreement regarding management and use of international water resources. The report is divided into: (1) factors affecting the ability to undertake cooperative action, (2) ways of foresting cooperation, and (3) institutional arrangements to facilitate joint action. The first section considers evaluative frameworks in co-riparian nations, uncertainty regarding possible effects of the agreement, boundary influences, international relations, domestic factors, and number of countries involved. Case studies cited: Pilcomayo River in the Rio de la Plata Basin (South America); Mono, Niger, and Senegal Rivers (northwest Africa); Columbia River (U.S.-Canada); Vardar-Axios River (Yugoslavia-Greece); Nile River (Egypt-Sudan); Indus River (India-Pakistan); Zambesi River (Zambia-Southern Rhodesia); and Rhine Basin (Europe). (Lynch-Wisconsin)
W80-00430

THE DESIGN AND EVALUATION OF INSTITUTIONAL ARRANGEMENTS FOR WATER PLANNING AND MANAGEMENT,
Colorado Univ., Boulder. Dept. of Economics.
For primary bibliographic entry see Field 6E.
W80-00431

WATER FOR THE THOUSAND MILLIONS,
Intermediate Technology Development Group, London (England).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 3, p 1105-1162.

Descriptors: *Water supply development, *Technology, *Developing countries, *Rural areas, *Appropriateness, *Analytical techniques, *Planning, *Rural sociology, Water resources development, Water supply, Water policy, Goals, Water management(Applied), Water conservation, Methodology, Social aspects, Economics, Public health, Evaluation, Africa, India, Intermediate technology, Classification, Rainwater catchment.

Experience since the 1940s with water supplies in developing countries especially for rural areas demonstrates that high-level technology is often untransferable to such areas, and most recently that attempts to use 'intermediate technology' also frequently fail because they are inappropriate to local social and economic conditions. This paper presents criteria for evaluating appropriateness of water supply technology in developing countries, classified by three categories of appropriateness (1) technology in developing countries, classified by three categories of appropriateness: (1) technical (health and sanitary, functional, environmental); (2) social; and (3) economic. These criteria cannot be applied, however, without first defining the goals and objectives of water supply improvement at the local level. A scheme is presented for identifying such goals according to: (1) immediate objectives (functional, other); (2) stage I goals (health, energy and time savings, social, economic); (3) stage II goals (health, social/technical, economic); and (4) stage III goals (social change, improved standard of living). After defining these goals, the three criteria of appropriateness can be analyzed according to each of these classes of objectives. It is noted that technology only has a role within its environment and socio-economic context, and that the most appropriate technology often is overlooked because the range of option is restricted. The criteria presented give a village-level perspective on what constitutes an appropriate water supply. (Lynch-Wisconsin)
W80-00432

ENVIRONMENTAL ISSUES IN RIVER BASIN DEVELOPMENT,
United Nations Environment Program, Geneva (Switzerland).
For primary bibliographic entry see Field 2A.
W80-00433

LONG-TERM PLANNING OF WATER MANAGEMENT,
Economic Commission for Europe (UN), Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, Part 3, p 1173-1260.

Descriptors: *Long-term planning, *Planning, *Water management(Applied), *Forecasting, *Analytical techniques, Water demand, Classification, Methodology, Industrial water, Hydroelectric power, Regional planning, River basin development, Water policy, Cost-effectiveness, Systems analysis, Economic Commission for Europe, Water supply.

Proceedings of the Seminar on Long-Term Planning of Water Management (Economic Commis-

sion for Europe) held at Zlatni Piasatzi, Bulgaria, May 1976, are presented. Part I contains the Seminar Report, including conclusions and recommendations, plus extracts from the opening statement. Part II contains seven introductory reports on four seminar topics. Seminar topics: (1) approaches, methods, and processes of long-term planning of water management (2) water use projection methods (industrial and public water demand, agricultural and hydroelectric power); (3) economic, environmental, and technical optimization in long-term water planning; and (4) long-term planning at the regional and river basin level. Conclusions deal with: (1) principles of long-term water management planning, (2) classification of planning (forecasts, plans), (3) long-term plans, (4) forecasting of water demands, (5) optimization, and (6) application to river basin and regional development. Recommendations: (1) extend long-term water management plans to 10-15 years, completed with master plans or forecasts for 30-50 years, with periodic revisions every five years; (2) consider technical, organizational, economic, and legislative effects, with attention to cost-effectiveness, social benefits, and environmental protection; (3) link water and land-use planning; (4) utilize systems analysis techniques; (5) base national water management on the river basin; and (6) use lower quality water for cooling and irrigation. (Lynch-Wisconsin)
W80-00434

RATIONAL METHODS OF FLOOD CONTROL PLANNING IN RIVER BASIN DEVELOPMENT,
Economic Commission for Europe (UN), Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, Part 3, p 1261-1322.

Descriptors: *River basin development, *Methodology, *Flood control, *Flood plains, *Planning, *Flood damage, Evaluation, Estimating, Regional planning, Costs, Developing countries, Data storage and retrieval, Automation, Flood forecasting, Flood plain insurance, Reservoirs, Policy, Governments, Water management(Applied), Europe.

The Economic Commission for Europe's Committee on Water Problems reports on: (1) existing methods of assessing flood damage; (2) flood phenomena; (3) legislation, organizations, methods, and policies in flood control planning; and (4) methods of evaluating the economic effectiveness of flood control measures. Reports of member countries are analyzed according to responses to several issues. Conclusions: (1) Proper flood plain use is of critical importance. (2) Crop insurance may be more effective than flood prevention where losses significantly affect the regional economy. (3) Forecasts are frequently based only on hydrometric data; meteorological data improves forecasting accuracy only slightly. (4) Data collection and transmission must be automated and forecasts connected to warning systems. (5) Use of reservoirs for flood control has shown inconsistent results. (6) Flood damage is greatly dependent on degree of economic development, corresponding to a range of protective structures from none (part of Africa and South America) through partial protection (India) to control structures and flood plains. (7) Flood damage may be estimated by restoration costs, comparative value of lost property and services, or capitalization of lost income. (8) Standing flood control committees at central and local levels facilitate coordination of national flood control policies. (Lynch-Wisconsin)
W80-00435

CMEA GLOSSARY ON WATER MANAGEMENT,
Economic Commission for Europe (UN), Geneva (Switzerland). Committee on Water Problems.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 3, p 1347-1552.

Descriptors: *Glossaries, *Water management(Applied), *Engineering, *Limnology, *Water pollution control, Reservoirs, Biology, Eutrophication, Hydrology, Hydrography, Groundwater, Lakes, Rivers, Hydroelectric power, Sewage treatment, Water purification, Water resources, Fish management, Sediments, Water chemistry.

A glossary of 1257 terms related to water management was prepared by the Council for Mutual Economic Assistance and translated under auspices of the U.N. Economic Commission for Europe's Committee on Water Problems. Although items are not arranged alphabetically, many are grouped by subject. Fields represented include limnology, aquatic biology, microbiology, hydrography, water chemistry eutrophication, pollution control, engineering, hydrology, soils, glaciology, sedimentology, sewage treatment, groundwater hydrology, hydroelectric power, water purification and treatment, reservoirs, water resources economics, law, and fish management. (Lynch-Wisconsin)
W80-00437

WATER RESOURCES, PLANNING AND MANAGEMENT: A SELECT BIBLIOGRAPHY,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 3, p 1553-1663.

Descriptors: *Bibliographies, *Water resources management, *Planning, *Water supply, *Technology, *Water law, Water demand, Training, Education, Water resources development, Water resources, United Nations, Forecasting, Water pollution, Water quality, Legal aspects, Desalination, Financing, Economics, International law.

A 111-page bibliography on water resources, water resources planning, and water resources management prepared by the United Nations' Dag Hammarskjold Library contains nearly 1400 citations and primarily includes books and periodical articles published during the last 15 years. Only major United Nations documents and publications are included. Sources are organized according to: (1) water supply and demand (present situation, water resources development, projections); (2) technology (water quantity, water quality, desalination); (3) economic and financial aspects; (4) law (international, national and comparative); (5) administration, management, planning, and research); (6) training and education; (7) other bibliographies; and (8) reference works. Within sections 1-5 references are broken down by world regions. (Lynch-Wisconsin)
W80-00438

POLICY AND ORGANIZATION OF WATER RESEARCH IN THE UNITED KINGDOM.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1665-1678.

Descriptors: *United Kingdom, *Research and development, *Research priorities, *Institutions, *Administrative agencies, *Water policy, *Water management(Applied), Water resources development, Water Research Centre(United Kingdom), History, Planning, Sewage treatment, Water supply, Sludge treatment, Eutrophication, Water pollution control, Water distribution, Coasts, Estuaries, Fisheries, Recreation.

The background, current policy and institutional structure of water research in the United Kingdom are described, emphasizing practical problems of water management. Major research needs of the water industry in the United Kingdom are summarized under: (1) resources planning and management, (2) water treatment, (3) sewage treatment, (4) sludge treatment and disposal, (5) water distribution and sewerage, (6) coasts and estuaries, (7) fisheries and recreation, and (8) longer-term environmental problems. The Water Act of 1973 reorganized the water industry in England and Wales, replacing approximately 180 water projects and 29 river authorities controlling river management, and 1300 sewage authorities controlling sewage disposal, with 10 multipurpose water authorities, nine in England and one in Wales. An attempt was made to unify clean and dirty water aspect of the industry in the new, largely autonomous authorities. A policy review group recommended organizing research and development according to the customer/contractor principle. Accordingly, the former Water Research Association and the Water Pollution Research Laboratory were combined to form the new Water Research Centre, a multi-disciplinary organization employing some 250 scientists and engineers. It is financed by membership (U.K. water authorities, plus other domestic and foreign organizations), contracts, and grants. There are plans to include the Water Research Centre in a new body, the National Water Authority, which would among other duties, undertake research for the industry. (Lynch-Wisconsin)
W80-00439

ENVIRONMENTAL ASPECTS OF POLLUTION CONTROL IN HUNGARY,
Research Inst. for Water Resources Development, Budapest (Hungary).
P. Benedek, and T. Simo.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1693-1709.

Descriptors: *Hungary, *Water pollution control, *Systems analysis, *Mathematical models, *Danube River Basin, *Planning, Rivers, River basins, International cooperation, Model studies, Pollution abatement, Environmental effects, Water supply, Tisza River, Sajo River, Water balance, Regional planning, Simulation analysis.

Interrelationships of all natural and economic factors must be considered in planning and implementing environmental protection measures, which form an integral part of regional planning and systems analysis. Of Hungary's surface water supplies, about 96% originate outside the country. The Danube River forms the backbone of surface water supplies. The critical period for the water balance in Hungary is August, when surface water resources of 85% duration derive 90% from the Danube system (70% from the Danube main stem, 20% from the Drava River, and 10% from the Tisza system). Monthly profile analyses are performed on major streams. The Danube provides 50% of industrial water demand and 25% of domestic demand (primarily by means of bank filtration wells), and is increasingly used for recreation. Although the river can assimilate its effluent load over most of its length, in the Hungarian section some elements now require waste treatment, for which water quality systems analysis is being used. The comprehensive environmental system comprises: (1) a water quality data collection network, (2) water quality simulation models, and (3) appraisal of alternative measures. Two examples of water quality systems analysis in Hungary are described: (1) the Sajo Valley optimization model, and (2) the descriptive water quality component model for the Danube. The former uses the mass balance of oxidizable pollutants discharged into the river, and the latter will combine sub-models on hydraulics, hydrology, chemistry, biology, bacteriology, etc. into a final river model. (Lynch-Wisconsin)
W80-00441

POLISH RESEARCH PROGRAM FOR SYSTEM-ORIENTED REGIONAL MANAGEMENT OF WATER RESOURCES,
Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.
J. Kindler.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1747-1754.

Descriptors: *Poland, *Water management(Applied), *Research and development, *Regional planning, *Water resources development, *Systems development, Economic development, Governments, Hydraulic engineering, Agriculture, Industrial water, Mathematical models, Model studies, Planning, Municipal water, Water supply development.

The Polish government research program for development and utilization of water resources was one of eight such programs established in 1974 to solve problems critical to economic and social development of the country. The program, to be carried out 1976-85, provides for: (1) development of a scientific and organizational base for implementation of the national water management system, and (2) realization of two regional pilot water resources systems, one in an urban/industrial area and the second in an agricultural zone. The program comprises: (1) a methodological base for system-oriented water management; (2) modernization and expansion of data collecting/processing systems on water quality and quantity; (3) technology and facilities for water quality control; (4) modern technology in hydraulic engineering; (5) an urban/industrial pilot water resources system; and (6) an agricultural pilot system. Total water demand is expected to rise from 9.0 billion cu m/yr in 1970 to 35.4 billion by 1990. The rise is associated with an increase in the volume of wastes needing treatment before disposal; excessive pollution could be the barrier limiting the volume of available water resources. Water resources systems differ from the traditional water system in encompassing not only supply but also all factors relating to water utilization by the population and the national economy. (Lynch-Wisconsin)
W80-00444

RIVER BASIN MANAGEMENT IN THE UNITED KINGDOM.
Department of the Environment, Reading (England). Central Water Planning Unit.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1847-1876.

Descriptors: *River basin development, *Water management(Applied), *United Kingdom, *Water supply development, *Water demand, *Planning, Administrative agencies, Institutions, Water pollution control, Monitoring, Information requirements, Financing, Regional planning, Forecasting, Water conservation, Flood control, Water resources development, Drainage, Sewage treatment, Hydrology.

Various aspects of river basin management in the United Kingdom are discussed, including: (1) institutional arrangements; (2) information requirements regarding water quality, water demand, sewerage, land drainage, amenity, and recreation; (3) water resources assessment and development; and (4) financing and planning. River basins provide water management boundaries in England and Wales but not in Scotland and Northern Ireland. In England and Wales the Water Act of 1973 created 10 multipurpose regional water authorities to replace 29 river authorities, the public water supply utilities, and over 1000 sewage treatment authorities. A National Water Council advises the government on water policy, assist water authorities, provide training, and promote research. Other new agencies are the Central Water Planning Unit, Water Data Unit, and Water Research Centre. Water planning is based on: (1) assessment of water resources, and (2) estimation of water demands. Measurement of hydrological variables has so far absorbed most of the information effort, including rainfall, streamflow, groundwater level, and water quality. Future demand is projected from past water demand records. Most new reservoirs in England and Wales are destined for river regulation or, if for direct supply, are filled by pumping from a river, and many water utilities now receive at least part of their supplies from river intakes, a major departure from the conventional upland impounding reservoirs supplying piped water directly to towns. (Lynch-Wisconsin)
W80-00449

THE LONG-TERM NATIONAL PROGRAMME FOR RIVER BASIN DEVELOPMENT, BASIS OF THE WATER MANAGEMENT POLICY IN ROMANIA,
O. Blaga, A. Filotti, and C. Rusu.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1887-1898.

Descriptors: *Romania, *Water management(Applied), *River basin development, *Long-term planning, *Water supply development, *Flood control, Soil erosion, Planning, Water policy, Socialism, Hydrography, Networks, Reservoirs, Diversion structures, Hydroelectric power, Irrigation, Water pollution control, Navigation, Water resources development, Water demand, Rivers, Danube River.

A long-term national program for river basin development in Romania enacted in 1976, covers: (1) systematization of the nation's hydrographic network during the next 30 years, (2) regulation of all watercourses, (3) construction of storage reservoirs and irrigation systems, (4) water pollution and soil erosion control, (5) hydroelectric power development, (6) improvement of inland navigation, (7) increasing fish breeding, and (8) flood control. Romania's water resources are limited to inland rivers, the Danube River, and subsurface waters. Inland rivers contribute only 37 billion cu m/yr and are frequent. River basin development will be based on reservoir construction and flow diversions. The long-term goal is 1400 reservoirs with a capacity of 34 billion cu m; for 1990 the goal is 1400 reservoirs with a capacity of 22 billion cu m. Water demand is estimated at 22.4 billion cu m for 1980, 35.0 billion for 1990, and 46.0 long-range. In 1975 39% of water went to industrial uses, 10% for drinking supplies and 5% of it to irrigation and other uses. Total hydropower potential is estimated to be 38 billion kwh/yr. Flood control has been carried out by dikes and embankments; new measures for flood control and agricultural protection include reservoirs, dredging, and soil erosion and excess moisture control. Pollution control measures include advanced wastewater treatment, industrial pollutant elimination, and water recycling. (Lynch-Wisconsin)
W80-00450

FINNISH EXPERIENCES IN WATER-RESOURCES PLANNING AND MANAGEMENT POLICY,
National Water Board of Finland, Helsinki.
A. Haverinen.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1907-1912.

Descriptors: *Finland, *Regional planning, *Water management(Applied), *Water policy, *Water resources development, *Water supply development, *Groundwater, *Water sources, Nonpoint pollution, Agricultural runoff, Irrigation, Water balance, Water pollution control, Waste water treatment, Administrative agencies, Institutions, Water utilization, Water conservation, Surface waters, Lakes.

Regional plans in Finland for water resources management and development deal comprehensively with water use and conservation. Water resources development planning is carried out by the National Board of Waters. Finland is divided into 19 planning regions based on large drainage basins or economic areas. Despite abundant surface water resources, including 55,000 lakes, the more-scarce groundwater is preferred for community water supply because: (1) it can often be used without treatment or with only neutralization, (2) it is more economical in sparsely settled areas, (3) surface waters often have high humus content requiring chemical treatment, and (4) surface waters are more susceptible to such contaminants as radioactive pollution. Centralized wastewater treatment is superior to use of several smaller plants due to economies of scale and better control of discharges. Industrial water supply generally comes from surface waters. Reduction of industrial water consumption is encouraged by water recirculation and reuse, dry manufacturing processes, and lower supply and treatment costs with lower consumption. Heavily polluting industries are prohibited from special protection areas, and new pulp and paper mills are usually not located near inland lakes. Irrigation water supply is enhanced by dams, lake flow regulation, artificial lakes, and flow diversion. Measures enacted to reduce diffuse load from agricultural and forest areas are listed. (Lynch-Wisconsin)
W80-00451

EXPERIENCES IN JOINT ADMINISTRATION OF BORDER WATERCOURSES,
E. J. Manner, and J. U. Ratia.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1915-1933.

Descriptors: *Administration, *International cooperation, *Treaties, *International waters, *Water management(Applied), *Finland, Soviet Union, Norway, Sweden, Tornio River Basin, River basins, Rivers, Watershed management, Governments, Political constraints, River basin commissions.

The structure and provisions of individual treaties signed by Finland with Sweden, the Soviet Union, and Norway for joint administration of watercourses shared by the countries reflect the different geographical and political circumstances affecting each agreement. The 1971 Frontier-Rivers Treaty with Sweden is particularly extensive and detailed, covering all water uses and all waterways of the entire Tornio River drainage basin. The boundary between Finland and Sweden runs for almost its whole length along rivers of the basin, and the two countries have similar legal systems and support private property rights. The treaty provides for a joint administrative commission, which can be considered part of the local administration system of each country. The Finland-Soviet Union treaty of 1964 governing Frontier-Watercourses, while covering all areas of water economy, does so in much broader outline. The common boundary seldom runs along rivers, instead crossing numerous watercourses. Thus the agreement provides for a joint administrative commission with a general framework capable of incorporating all the special needs of the diverse watercourses. The commission is primarily a cooperative organ whose function is to assist each government; it has little contact with private citizens or enterprizes. The treaty reflects the different economic and administrative systems of Finland and Russia. The arrangements with Norway took the form of individual treaties, each dealing with specific uses of only one watercourse; no joint commission was established. (Lynch-Wisconsin)
W80-00452

THE WORLD'S WATER IN A HUMAN PERSPECTIVE.
Holy See, Vatican City (Italy)
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1941-1950.

Descriptors: *Water resources development, *Water management(Applied), *Human rights, *Water supply development, *Water shortage, *Social needs, Agriculture, Foods, Crop production, Droughts, Flood control, Irrigation, Rural areas, Water conservation, Public health, International cooperation.

This paper maintains that water supply is a human right, a factor which must be kept in mind in all efforts at water resources development. Water development issues affect the individual, such as: (1) community water supply; (2) agriculture, irrigation, and food production; (3) flood control; and (4) drought. A global study of water, such as the 1977 United Nations Water Conference, must consider the total environmental context and the dynamic ecological interrelationship between water and man. About 86% of the world population does not have access to local public water, which is a critical element in public health and economic development. In rural areas about two billion people live in great poverty; the international community must promote sound water management policies in its program to eradicate rural poverty. The long-term aim of irrigation schemes is self-

supporting agriculture, indispensable for true rural development. Several instances are cited to illustrate these concepts. (Lynch-Wisconsin)
W80-00453

WATER RESOURCES DEVELOPMENT, AND MANAGEMENT PLANNING IN ARID ZONES: CASE HISTORY-ISRAEL,
Tahal Consulting Engineers (Israel).
A. Wiener.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2045-2058.

Descriptors: *Israel, *Water resources development, *Water supply development, *Water conservation, *Arid lands, *Planning, Irrigation, Regional planning, Model studies, Information exchange, Institutions, History, Networks, Lake Kinneret(Israel), National water carrier, Engineering, Water reuse, Recycling.

Systematic water resources development in Israel began with the first master plan draft completed in 1950. Planning has consisted of a successful combination of national systemic planning and regional project-by-project suboptimization. Israel currently uses about 95% of its conventional water resources (1650 million cu m); the remainder, mostly reclaimed and renovated municipal and industrial sewage, will be utilized within five years. A national water grid, consisting of local and regional schemes incorporat in underground, spring, and river waters, and renovated sewage flows, is fully integrated and controls two-thirds of the water supply; the rest is controlled through administrative allocation mechanisms. The schemes are interconnected through the National Water Carrier, a 20cu m/sec pipeline-tunnel-canal linking the central and southern coastal plain with Lake Kinneret (Sea of Galilee), a natural storage reservoir which serves as a seasonal and cyclical regulator. Technological approaches used include: (1) water conservation; (2) recycling and renovation of waste waters; (3) use of engineering to minimize waste and water losses, emphasizing irrigation efficiency; (4) substitution of alternative inputs or water-conserving investments for water; (5) manipulation of the hydrological cycle to improve net water yield, such as by cloud seeding, evaporation suppression, and improving runoff from noncultivated areas; and (6) use of physical, analog, and digital modeling tools. (Lynch-Wisconsin)
W80-00457

HYDROLOGICAL FORECASTING FOR OPERATIONAL PLANNING AND MANAGEMENT OF WATER RESOURCES,
For primary bibliographic entry see Field 2E.
W80-00467

RIVER BASIN PLANNING IN CANADA,
Department of the Environment, Ottawa (Ontario). Water Planning and Management Branch.
D. Bellinger.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2341-2368.

Descriptors: *Canada, *Regional planning, *Comprehensive planning, *Water management(Applied), *River basin development, *Water resources development, Planning, Institutions, Administration, Governments, Federal government, Jurisdiction, Cooperation, Methodology, Analytical techniques, Eutrophication, Flood control, Water pollution control, Thames River Basin(Ontario, Canada), Qu'Appelle River Basin(Canada), Groundwater.

Planning has been used in Canada since the late 1960s to define and resolve river basin problems. Although Canada possesses abundant water, there are problems of poor distribution, low flow, flooding, inadequate groundwater, industrial pollution, and recreation. Planning and management techniques, methodologies, and experiences are described, and an appendix overviews 15 water resource planning studies. Initial emphasis on large structures in the first half of the 1960s, with planning and management left to provincial governments, gave way in mid-decade to a legislative and organizational approach in response to public concern for environmental degradation. The Canada Water Act of 1970 provided joint federal-provincial consultation on priorities, planning, and implementation of water programs, with emphasis on integrated, comprehensive management of natural resources. Joint participation by federal and provincial authorities overcomes the problem of divided jurisdiction and provides planning input of all financial contributors, public participation, and incorporation of national and regional priorities. Limitations include delays in implementation. Preplanning studies are useful for clarifying priorities, designing complete studies, and producing early cost estimates. (Lynch-Wisconsin)
W80-00472

IRRIGATION MANAGEMENT IN DEVELOPING COUNTRIES: A SUGGESTED ACTION PROGRAMME,
Overseas Development Inst., London (England).
For primary bibliographic entry see Field 3F.
W80-00481

AN ANALYSIS OF VALUES FOR DEVELOPMENT OF RECREATIONAL POLICY,
State Univ. of New York Coll. at Brockport.
D. L. Groves, and H. Kahalas.
International Review of Modern Sociology, Vol 8, No 1, p 103-112. January-June 1978. 27 ref.

Descriptors: *Recreation demand, *Valuation, *Policy, *Social values, *Methodology, *Behavior, Recreation, Recreation facilities, Governments, Decision making, Planning, Attitudes, Theoretical analysis, Sampling, Surveys, Evaluation, Public relations, Public sector, Land use, State College(PA), Pennsylvania.

To provide a sociological policy-making framework for public agencies in charge of managing recreational lands, core and peripheral values of the public were identified on the basis of cognitive, affective, and action-tendency components of user and general populations. A series of judgmental and situational independent variables were used to group these values and to identify significant relationships. A time budget was also used to assess behavioral patterns. A case study was undertaken at State College, Pennsylvania. Interviews were conducted based on a proportionate, stratified, random sampling technique. Factor analysis was used to select several independent variables for discriminant analysis. Significant relationships for the general population were found for symbolic meaning, sex, and age, and for users for use meaning, sex, free time, and residence. There was notably little relationship with behavioral variables, whereas situational and judgmental variables such as sex and meaning were important in forming an individual's priorities. Policy should be directed toward educational programs to help the public clarify its values relative to recreational lands. (Lynch-Wisconsin)
W80-00500

IMPLEMENTATION STRATEGIES FOR PUBLIC LAW 92-500, SECTION 208,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
For primary bibliographic entry see Field 6E.
W80-00524

APPROPRIATIVE WATER RIGHTS AND EFFICIENT ALLOCATION OF RESOURCES,
New Mexico Univ., Albuquerque.
For primary bibliographic entry see Field 6E.
W80-00548

IMPACT ASSESSMENT OF WATER RESOURCE DEVELOPMENT ACTIVITIES: A DUAL MATRIX APPROACH,
Fish and Wildlife Service, Kearneyville, WV. Water Resources Analysis.
For primary bibliographic entry see Field 6B.
W80-00550

SCREENING OBJECTIVES AND UNCERTAINTIES IN WATER RESOURCES PLANNING,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
P. H. Byer.
Water Resources Research, Vol. 15, No. 4, p 768-774, August 1979. 2 fig, 5 tab, 8 ref, 1 append.

Descriptors: *Screening models, *Water resources, *Alternative planning, *Uncertainties, *Objectives, Probability, Effects, Dams, Multiple-purpose reservoirs, Decision making, Equations, Mathematical models, Systems analysis, First-order estimates, Utilities, System attributes.

A procedure for helping analysts to choose the objectives and uncertainties to be considered in the evaluation of alternative system designs has been developed. Two models are described, one for screening system attributes (and their related objectives) and one for screening uncertainties about the levels of these attributes. The models use first-order estimates of utilities and probabilities to calculate a measure of the maximum expected effect on the results of the evaluation of not considering an objective or of assuming certainty, rather than uncertainty, about the levels of an attribute. The models are applied to the problem of planning a hypothetical multipurpose dam and reservoir system. (Bell-Graf--Cornell)
W80-00551

APPLIED WATER RESOURCE SYSTEMS PLANNING,
D. C. Major, and R. L. Lenton, Eds. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1979. 248 p.

Descriptors: *Water resources development, *Alternative planning, *Methodology, *Mathematical models, *Rio Colorado(Argentina), *Multiobjective, Simulation analysis, Optimization, River systems, Programs, Projects, Decision making, Economics, Engineering, Hydrology, Equations, Systems analysis, Screening model, Sequencing model.

Demonstrated is the application of water resource systems planning techniques to the Rio Colorado, Argentina. The goals of the Rio Colorado study, part of a broader contract to bring modern river basin planning methods to Argentina, were (1) to illustrate these methods via application and thus (2) to enable decision makers to understand the physical, economic, and social trade-offs involved in the choice of a development scheme for the river, thereby assisting them in choosing among alternative development plans. The book is organized into three parts. Part One provides the background to the study; a description of the Rio Colorado and its development sites; the authors' methodology, including multiple planning objectives and mathematical modeling; and an overview of the system models used to generate development programs for the river. Part Two contains descriptions of each of the four principal models used in the study; three were used to generate program alternatives--screening model, basic simulation model, and sequencing model--and one was used for data generation and model verification--the detailed simulation model. Part Three contains the parameter inputs to the models, model results, and interpretations of the work. Explained is the use of this book as a teaching aid. The modeling approach is to find development alternatives which maximize the economic and engineering benefits. (See also W80-00555 thru W80-00565) (Bell-Graf--Cornell)
W80-00554

THE RIO COLORADO BASIN,
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 13-28, 1979. 7 fig, 15 ref.

Descriptors: *Rio Colorado basin(Argentina), *Sites, *Water resources development, *Rivers, Irrigation, Power, Reservoirs, River flow, Interbasin transfers, Regions.

Provided is an overview of the Rio Colorado basin and a description of the potential reservoir, irrigation, power, and interbasin diversion sites along the river. The chapter has four sections: a general description of the Rio Colorado and its economy, and descriptions of each of the three main regions--the upper, middle, and lower basins--and the project sites contained in each. A map of the Rio Colorado basin and a profile of the river are given; presented also are maps of the three main regions and a figure showing the flow pattern of the river at Pichi Mahuida. (See also W80-00554) (Bell-Graf--Cornell)
W80-00555

PLANNING THEORY: MULTIOBJECTIVES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
D. C. Major.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 29-36, 1979. 1 fig, 24 ref.

Descriptors: *Multiobjective theory, *Planning, *Water resources, Programs, Design, Optimization, Cost-benefit analysis, Benefit maximization, Regional analysis, Social aspects, Economics, Decision making, Rio Colorado(Argentina), Systems analysis.

Presented is an introduction to the use of multiple social, economic and regional objectives in water resources planning (rather than the single objective of maximizing 'economic' benefits as in traditional benefit-cost analysis). In general, multi-objective theory provides the basis for moving from the objectives of society to system design in an iterative fashion, using the four steps in system design suggested in 'Design of Water Resource Systems,' by Maass, et al. The theory is concerned with the choice of objectives, the development of alternative feasible plans responsive to objectives, and the final choice of a plan. Rules for counting national and regional benefits differ. Considered are the sectoral planning possibilities, the role of preferences in multiobjective theory, optimal program design, and applications of multiobjective planning. (See also W80-00554) (Bell-Graf--Cornell)
W80-00556

PLANNING THEORY: THE ROLE OF MATHEMATICAL MODELS IN WATER RESOURCES PLANNING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
F. E. Perkins.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 37-46, 1979. 21 ref.

Descriptors: *Water resources, *Planning, *Mathematical models, *Optimization, *Simulation analysis, Rio Colorado(Argentina), Decision making, Systems analysis, Linear programming, Nonlinear programming, Dynamic programming, Integer programming, Multiobjective, Investment criteria.

Introduced is an approach to using mathematical modeling methods for water resources planning, and in particular, to the combined use of several types of models to generate alternative development configurations for a river. This approach is considered the second of two main conceptual bases for the study of Rio Colorado (the first being the use of multiple social, economic and regional objectives in water planning), and it can be related to the overall process of water resources planning in terms of the four steps in system design suggested in 'Design of Water-Resource Systems' by Maass et al, 1962. Certain characteristics of the water planning process are suggested, i.e., its dynamic nature, to define the role models should play within that process. Many models may be viewed as tools from which to derive answers to well-posed questions concerning system performance or behavior. The models must provide quantitative and sufficiently detailed information. Discussed are three valuable functions models can fulfill: amplification, organization, and evaluation. All mathematical models are constructed from three fundamental components: parameters, variables and constraints. Described is a categorization scheme for optimization models: linear programming; integer programming; nonlinear programming; and dynamic programming. Simulation models are categorized in terms of their likely components: inputs; physical relationships; nonphysical relationships; operating rules; and outputs. The chapter closes with a discussion of choosing the appropriate model for a particular situation. (See also W80-00554) (Bell-Graf--Cornell)
W80-00557

PLANNING FOR THE RIO COLORADO: AN OVERVIEW,
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 47-55, 1979. 2 fig, 6 ref.

Descriptors: *Rio Colorado(Argentina), *Alternative planning, *Methodology, *Mathematical models, *Multiobjective investment criteria, *River basins, Screening model, Sequencing model, Simulation model, Economics, Development sites, Systems analysis.

Presented is an overview of the methodology applied to the Rio Colorado (Argentina) in the joint study of the Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics and of MIT. The method entails: a series of models used to generate alternative plans for the river; and the multiobjective investment criteria embodied in the models. Described are the system of models used, the investment criteria, and a representation of the river basin and its potential development sites as used in the models. Included are a screening, a simulation, and a sequencing model. After discussing objectives for the Rio Colorado, the following multiobjective investment criteria are considered: benefit and cost accounting rules; interest rates; budget constraints; risk and uncertainty; pricing and cost allocation for multiobjectives; scheduling; and the relationship of sectoral planning to national parameters. (See also W80-00554) (Bell-Graf--Cornell)
W80-00558

THE MATHEMATICAL PROGRAMMING SCREENING MODEL,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
J. Cohon, T. Facet, and D. Marks.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 59-81, 1979. 9 fig, 1 tab, 46 equ, 4 ref, 2 append.

Descriptors: *River systems, *Planning, *Constraints, *Model studies, *Screening model, *Water resources, *Planning, Projects, Hydrologic aspects, Steady-state, Dams, Capital costs, Reservoir storage, Streamflow, Regression analysis, Mixed-integer programming, Algorithms, Equations, Systems analysis, Irrigation, Hydroelectric power, Optimization, Benefit maximization, Water policy, Conditionality.

The screening model described herein was used in the Rio Colorado study to choose initial configurations of plan elements, the most promising of which were subjected to further analysis by simulation. The steady-state model presented uses deterministic, mean hydrologic inputs. The projects selected in a given run are assumed to be implemented in the first year of a 50-year planning period, each year of which is taken to be the same hydrologically. Each year is composed of three 4-month seasons. The objective function is the maximization of net benefits; the formulation utilizes integer variables to represent dam capital costs, and for certain other purposes, and it is solved with a mixed-integer programming algorithm. The model is disaggregated into eight sections of the following constraints: continuity, reservoir, irrigation, hydroelectric energy, import/export, conditionality, and policy constraints, and finally the objective function; each of these aspects of the model is detailed. (See also W80-00554) (Bell-Graf--Cornell)
W80-00559

SIMULATION ANALYSES: THE BASIC MODEL,
Waterloo Univ. (Ontario) Department of Civil Engineering.
E. Mcbean, R. Lenton, and J. C. Schaae Jr.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 82-94 1979. 5 fig, 1 tab, 6 equ, 5 ref.

Descriptors: *Simulation analysis, *Model studies, *River systems, *Planning, *Screening model, *Rio Colorado(Argentina), Networks, Design, Reservoirs, Irrigation, Streamflow, Stochastic processes, Synthetic hydrology, Hydroelectric power, Equations, Effects, Benefits, Water allocation(Policy), Exports, Operating rules, Objective function.

The Rio Colorado study has introduced an approach for generating alternative river basin plans, combining the use of a screening, a simulation, and a sequencing model. The screening model is used to provide preliminary development configurations responsive to alternative objectives and constraints. The basic simulation model is a mathematical representation designed to estimate the contributions to objectives that would result if a proposed set of management and development measures was implemented. This chapter describes the background, general nature, and overall structure of the simulation model. Then the parts of the model representing irrigation, power, exports, water allocation rules, reservoir operating rules, and the objective function are characterized. These descriptions relate the details of the various components of the basic simulation model to those of the screening model; in each case, the differences are due primarily to the use of stochastic hydrology in the simulation model. Considered are: (1) the river system as a network of nodes; (2) synthetic streamflow; (3) the relationship of the two models; and (4) the parts of the model. A second, detailed simulation model has been developed for physical simulation of specific basin components and is described in a later chapter. (See also W80-00554) (Bell-Graf-Cornell)
W80-00560

SIMULATION ANALYSES: THE DETAILED MODEL,
Simon Bolivar Univ., Caracas (Venezuela).
For primary bibliographic entry see Field 2A.
W80-00561

THE MATHEMATICAL PROGRAMMING SEQUENCING MODEL,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering.
T. Facet, J. Cohon, and D. Marks.
In: Applied Water Resource Systems Planning, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 112-130, 1979. 8 fig, 22 equ, 6 ref, 2 appen.

Descriptors: *Model studies, *Alternative planning, *River basin development, *Water resources, *Sequencing model, Methodology, Equations, Mathematical models, Systems analysis, Irrigation, Projects, Constraints, Optimization, Benefit maximization, Power, Budget, Human population, Rio Colorado(Argentina).

Described is the model used to sequence alternative development plans for the Rio Colorado in Argentina. The planning methodology used for the river began with the application of a screening model and continued with the use of a basic simulation model designed to estimate the contributions to objectives that would result if a proposed set of managementand development measures were implemented. The result of applying these two models has been a set of projects, or basin confiurations, of determined sizes and locations. In the sequencing model, such a set of projects is scheduled optimally in four future time periods: The question is, During which time periods should they be constructed. With an objective function of benefit maximization, the model accounts for the following aspects in the scheduling: Decision benfits over time; budget contraints; constraints on the number of farmers available to work new irrigation areas; and project interrelationships such as the

necessity to ensure that an irrigation area is not built before the construction of a dam to supply it. Provided herein is a description of the general characteristics of this model, and then particular aspects of the model are discussed: Continuity constraints; the representation of irrigation and power projects; conditionality constraints; budget and population constraints; and the objective function.The article is followed by two appendices: (1) sequencing model formulation for an example configuration; and (2) list of symbols used in the sequencing model. (Janet Bell-Graf--Cornell
W80-00562

OUTPUTS OF THE MODELS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
J. Cohon, T. Facet, W. Grayman, and G. Vicens.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p 178-224, 1979. 7 fig, 45 tab, 1 append.

Descriptors: *River basin development, *Simulation analysis, *Model output, *Screening model, *Sequencing model, *Rio Colorado(Argentina), Methodology, River systems, Power, Irrigation, Economics, Projects, Efficiencies, Alternative planning, Optimization, Equations, Systems analysis, Multiobjective, Regional income, Sensitivity.

Described are outputs of the system of models used to generate program alternatives for the Rio Colorado; the purpose is to illustrate how the models reflect the physical and policy choices relevant to the development of the basin and to provide insight into the tradeoffs among these choices. First, reviewed briefly are the process and meaning of model use in the Rio Colorado study methodology. Then outputs of the three models are discussed, respectively: 21 screening runs, 4 simulation analyses, and 3 sequencing runs; accounted for are the Argentine objectives for river basin development. The schematic of the basin used in the models has been reproduced as an aid in interpreting results. The full results of the runs discussed are presented in tabular form in Appendix 11A for those who wish to analyze aspects of the results not discussed in the Chapter. (See also W80-00554) (Bell-Graf--Cornell)
W80-00565

OPTIMAL MANAGEMENT OF A MULTIRESERVOIR WATER SUPPLY SYSTEM,
IBM Scientific Center, Haifa (Israel).
For primary bibliographic entry see Field 4A.
W80-00583

DIGITAL MODEL OF THE HOLLISTER VALLEY GROUND-WATER BASIN, SAN BENITO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
G. W. Kapple.
Geological Survey Water-Resources Investigations 79-32 (open-file report), March 1979. 17 p, 3 fig, 6 plates, 9 ref.

Descriptors: *Model studies, *Aquifer characteristics, *Groundwater resources, *Groundwater availability, Water supply, Water demand, Projections, Pumping, Groundwater recharge, Water levels, Hydrogeology, Groundwater movement, Maps, Analytical techniques, California, *San Benito County, *Hollister Valley.

A two-dimensional finite-difference digital model was constructed to simulate effects of proposed pumping and recharge schemes on water levels in the Hollister Valley ground-water basin. Pumping rates in the valley are expected to increase from 24,000 acre-feet per year in 1968 to an ultimate rate of 38,500 acre-feet per year. The model was calibrated for the period 1940-51 and tested by simulating water-level changes from 1951 to 1968. Model-generated water levels were generally within 15 feet of observed water levels for the calibration period. For the testing period, computed and observed water levels differed by as much as 35 feet in parts of the study area. Discrepancies in the test results may be caused by errors in historical pumpage data or by unidentified faults or local semiconfined conditions. Under one proposed development scheme, model-predicted water levels to the year 2020 declined up to 170 feet in previously undeveloped areas. For developed areas near the city of Hollister, water-level declines of 100 to 125 feet were predicted for the same period. (Woodard-USGS)
W80-00756

DETERMINATION OF PEAK DISCHARGE FROM RAINFALL DATA FOR URBANIZED BASINS, WICHITA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
C. O. Peek, and P. R. Jordan.
Geological Survey open-file report 78-974, October 1978. 49 p, 8 fig, 6 tab, 19 ref, append.

Descriptors: *Peak discharge, *Rainfall-runoff relationships, *Storm runoff, *Urbanization, *Hydrographs, Design flood, Synthetic hydrology, Flood frequency, Evaluation, *Kansas, *Wichita(Kans).

Rainfall and runoff data from urbanized drainage basins in the Wichita area, Kansas, were used to evaluate the Soil Conservation Service synthetic-hydrograph method of computing flood hydrographs from rainfall data. The method was tested on six basins where the impervious surface ranged from 11 percent on the least urbanized basin to 40 percent on the most urbanized. Twenty-two of the largest storm events for which peak discharges had been observed were used in the test. After modification of the method for this particular area, results showed an average error of 20 percent, disregarding sign, with an apparent bias of 8 percent. However, uncertainties in some of the data make it impractical to adjust for bias. Application of the modified method using data on rainfall, impervious surface, soils, land use, channel slope, length of main channel, and drainage area is described for a hypothetical basin. As an alternative to more complete and complex modelling by digital computer, a peak discharge for drainage design can be calculated by applying the Soil Conservation Service method to a standardized 'design storm' for a specified recurrence interval. The method is sensitive to soil conditions and land use; therefore, accurate information on these factors is necessary. (Woodard-USGS)
W80-00774

6B. Evaluation Process

EVALUATION OF ECONOMIC BENEFITS OF HYDROLOGICAL SERVICES,
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 2, p 699-720.

Descriptors: *Cost-benefit analysis, *Hydrological services, *Data collections, *Institutions, *Monitoring, *Planning, Administrative agencies, Economics, Benefits, Hydrology, Water resources development, Costs, Water management(Applied), Forecasting, Governments, Flood control, Research and development, Data processing, Information exchange, Water allocation(Policy), Surface waters, Groundwater.

A national hydrological service and its associated observational network, usually a governmental agency, is an essential governmental service in every country. Crucial to water management success, and therefore strongly interrelated with the development rate of the national economy, the hydrological service should carry the responsibility for research and development, training, and international cooperation. Hydrological services usually: (1) supervise field measurements of surface water and groundwater; (2) maintain the data bank; (3) process, publish, and disseminate information; and (4) evaluate water resources. Some of these bodies are also responsible for: (1) planning of water resources development investments, (2) water allocation and usage control, (3) water resources management, (4) research, and (5) advising other organizations. The service generally provides information free of charge. Two methods of conducting a cost-benefit analysis of hydrological networks are outlined. Network equipment, data collection and processing, hydrological analysis and forecasting, training, research, international activities, and administration are discussed. While some benefits of hydrological services can be evaluated in monetary terms, many are intangible. Information made available for future planning is of great importance, but benefits cannot be quantified at the time data is collected. Well defined benefits include planning of water works and flood control. (Lynch-Wisconsin)
W80-00414

PRINCIPLES AND METHODS FOR THE PROVISION OF ECONOMIC INCENTIVES IN WATER SUPPLY AND WASTE WATER DISPOSAL SYSTEMS.
Economic Commission for Europe (UN), Geneva (Switzerland).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 3, p 1323-1346.

Descriptors: *Methodology, *Incentives, *Economies, *Water supply, *Waste water disposal, *Water policy, Water management(Applied), Financing, Water supply development, Water utilization, Resource allocation, Water resources, Water demand, Use rates, Pollution taxes(Charges), Water pollution control, Polluter pays principle, River basins, Watersheds(Basins), Industrial water, Municipal water, Administrative agencies, Legal aspects, Sanctions.

The experience of member nations of the Economic Commission for Europe shows that economic incentives are necessary for balancing demand and supply in water resources management. This report presents an overview of the subject, conclusions, and a survey by country of the use of incentives in pollution control, water resources utilization, and stimulation of investments in water management development. Incentives in water pollution include: (1) payment for service rendered (price/cu m water), (2) indemnification for damage or legal violation (sanctions), and (3) direct and indirect economic incentives (charges, taxes, and tax abatement). In planned economies development of water management investment is entirely financed by the government, while in market economies local authorities and/or the state contribute loads, grants, or subsidies to construction. Conclusions: (1) An overall economic approach to water resources management is usually desirable at a certain stage in development, and is especially effective where formalized in a water act. (2) Administrative agencies are best organized by major watercourse basins. (3) Technical facilities are needed for supervision and control of incentives. (4) The 'polluter pays' principle is recommended. (5) While incentives for water quality protection are in wide use, incentives for more rational water use are in effect in few countries, but have been shown effective. (Lynch-Wisconsin)
W80-00436

METHODS FOR ESTIMATING GROUND WATER RESOURCES AND THE BALANCE OF SUBSURFACE WATERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Alfoldi, E. Almassy, and P. Major.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1679-1692.

Because of basin structure, hydrogeological conditions in Hungary favor development of subsurface water resources which play an important role in domestic water supply. Subsurface waters will continue to be important due to good chemical-biological characteristics, protection from pollution, and poor distribution of surface water supplies. Total water demand in Hungary was 5.3 cu km in 1970, and is expected to increase to 12.5 cu km/yr by 1985, with domestic consumption increasing by over 100% from 0.5 to 1.1 cu km/yr.

In 1970 water was piped to 55% of the population, to be extended to 85% by 1985. Increased water demand will be met primarily by surface storage, and domestic increase from subsurface supplies. About 1000 new wells are drilled annually, increasingly concentrated in groups. Some industries (pharmaceutical, food) require subsurface supplies, mainly for water quality reasons. Hungarian water resources were first estimated in the National Water Management Master Plan, approved in 1964. In estimating groundwater resources, volume available has been considered that above the deepest level of normal groundwater fluctuations. Water resources of Karstified rocks have been estimated on the basis of long records of some 1200 springs and precipitation data. The water balance of subsurface waters, based on a simple comparison of supply estimates with water use, indicates that 25% of subsurface supplies are already engaged, surpassing 100% in some areas. (Lynch-Wisconsin)
W80-00440

FLOOD INSURANCE OR DISASTER LOANS: AN ECONOMIC EVALUATION,
M. J. Rettger, and R. N. Boisvert.
OWRT A-074-NY(3), 14-34-0001-7068.

Descriptors: *Disaster loans, *Flood insurance.

Alternative federal flood disaster assistance programs are evaluated through an economic comparison of flood insurance and disaster loan programs. The distribution of costs, benefits, and program transfers, both private and public, are simulated over time and are analyzed to determine the sensitivity of program performance to specific program parameters. Empirical results demonstrate that both programs provide adequate levels of protection at approximately equivalent costs. Variations in premium and interest rate subsidies have major effects on the distribution of total costs between the public and private sectors.
W80-00492

WATER RESOURCES AND THE NATION'S WATER SUPPLY: ISSUES AND CONCERNS,
General Accounting Office, Washington, DC.
Report No. CED-79-69, April 13, 1979, 63 p.

Descriptors: *Water resources, *Water supply, *Water supply development, *Water management, *Financing, Ground water resources, Water resources development, Water Resources Planning Act, Interstate compacts, Water conservation, Cost repayment, Cost sharing, Evaluation, Federal government, Administrative agencies, Water use, Industrial water, Planning.

The Federal role in water resources planning stems from the Water Resources Planning Act of 1965 (PL 89-80). The General Accounting Office's (GAO) role is the reassessment of national concerns; this report represents the perspective GAO is using to organize and direct audit efforts for water resources projects. Principal agencies involved in water resources activities are identified and major issues and concerns are presented. Current GAO efforts are centered on the impact on water supplies of industrial water reuse and recycling and Department of Agriculture efforts to promote better water management and conservation. In the area of municipal and industrial (M&I) water supply the GAO audit work includes a review of actions by metropolitan areas to meet water needs, survey of M&I water distribution systems problems in large M&I cities and study of M&I water supply problems for small and rural communities. Financing, cost sharing and repayment policies are addressed, as well as requirements for various Federal agencies and programs. Problems impacting on construction and maintenance of water resources projects are identified. Problems and issues concerning ground water resources are presented. For each area of concern, past and current GAO emphasis is presented and GAO studies and reports are identified. (Iervolino-NC)
W80-00542

WATER SUPPLY FOR URBAN AREAS: PROBLEMS IN MEETING FUTURE DEMAND,
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6D.
W80-00543

COLORADO RIVER BASIN WATER PROBLEMS: HOW TO REDUCE THEIR IMPACT,
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-00545

WAYS TO RESOLVE CRITICAL WATER RESOURCES ISSUES FACING THE NATION,
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-00546

ANALYSIS OF OPERATIONS AND MAINTENANCE COSTS FOR MUNICIPAL WASTEWATER TREATMENT SYSTEMS,
Dames and Moore Water Pollution Control Engineering Services, Denver, CO.
Prepared for Environmental Protection Agency, Office of Water Program Operations, Washington, D.C., Report No. 430/9-77-015, February 1978. 265 p. 26 fig, 48 tab, 7 append.

Descriptors: *Wastewater treatment, *Treatment facilities, *Municipal wastewater, *Operating costs, *Maintenance costs, *Operation and maintenance, *Cost analysis, *Operations research, Economics, Costs, Sewerage, Methodology, Maintenance.

The purpose is to present the results and analyses of the most comprehensive survey made to date on the operation and maintenance (O&M) costs of the nation's municipal wastewater treatment plants and collection systems. The data for this study were gathered from a sample of 348 individual wastewater treatment plants and 155 sewer systems. Only treatment plants of 1.0 million gallons per day (mgd) capacity or larger were sampled. The cost data range from fourth quarter 1972 to first quarter 1977 and have been adjusted to third quarter 1977 dollars. The analyses in this study were performed with the assistance of a computer statistical package. The study quantified and confirmed certain economic principles relative to operating costs of process related facilities. The analyses indicate that the larger the plant, up to a limit of approximately .85 mgd, the lower the operation and maintenance costs per million gallons treated. For all types of treatment levels, personnel, power, and chemical expenditures accounted for approximately 80% of total operating costs. The total operating costs per capita are highest for sanitary sewer systems and lowest for a mixed system which has sanitary sewers plus storm sewer systems. The sanitary sewer system also has the highest per mile operating cost, and the mixed sewer system has the lowest maintenance cost per mile. (Iervolino-NC)
W80-00549

IMPACT ASSESSMENT OF WATER RESOURCE DEVELOPMENT ACTIVITIES: A DUAL MATRIX APPROACH,
Fish and Wildlife Service, Kearneyville, WV. Water Resources Analysis.
T. H. Yorke.
t No. FWS/OBS-78/82, September 1978. 27 p, 3 fig, 11 tab, 58 ref.

Descriptors: *Water resources development, *Fish and wildlife, *Water resources, Impacts, Water quality, Water quantity, Water flow, Impounded water, Control structures, Floodplains, Stream improvements, Channels, Beds(Stream), Channel erosion, Channel improvement, Levees, Dikes, Jetties, Locks, Dams, Bank stabilization, Flood protection, Flood control, Inter-basin transfers, Matrix system.

This report presents a dual matrix system for planning and evaluating the impact of water projects on fish and wildlife resources. The dual matrix system will (1) relate the resource development to physical change and then (2) relate the physical change to biological impact. The system utilizes the commonality of impacts on fish and wildlife resources associated with projects such as reservoirs, jetties and flood control levees. This report presents the first two components of the system--a general description of the system and a generalized matrix of the physical and chemical impacts of water resource development activities. Twelve water resource development activities are included in the matrix, and 10 physical-chemical characteristics are presented for each. Findings indicate that, in general, channel enlargement has many negative effects on a stream, increasing suspended solids and water temperature, and disrupting streambed equilibrium; channel realignment and clearing and snagging have somewhat less effect than enlargement; dikes and jetties can cause channel degradation; bank stabilization will tend to prevent natural stream migration and also deepen the channel; floodplain clearing may increase suspended solids and accelerate bank erosion; flood control impoundments will virtually halt all natural movement of bed material, as will hydroelectric impoundments, locks and dams; and that transbasin augmentation will accentuate velocity extremes of the stream. (Arnold-NC)
W80-00550

ECONOMIC PARAMETERS,
Institute of Water Economics, Law, and Administration (Argentina).
J. Pascuchi, W. Grayman, J. Suarez, and D. C. Major.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood, Cliffs, New Jersey, p 133-148, 1979. 2 fig, 5 tab, 11 ref.

Descriptors: *Methodology, *Mathematical models, *Irrigation, *Energy, *Benefits, *Economic parameters, Water resources development, Planning, Rio Colorado(Argentina), Costs, Estimating, Regional income, Opportunity costs, Imports, Exports, Shadow price, Systems analsis, Equations.

A planning methodology has been derived for the Rio Colorado in Argentina which utilizes a screening model, a basic simulation model, and a sequencing model for deriving optimal water resources management alternatives. This chapter explains the methods used to derive the principal economic parameters required by the models. These parameters include: benefits for irrigation and energy, including benefits from the export of water to the Rio Atuel basin, Mendoza; the opportunity costs of imports from the Rio Negro system; regional income costs and benefits; the shadow price on foreign exchange; and budget and population limits on development. The values of the parameters in each section are presented in terms of the model parameter notation used for the screening and simulation models. The planning horizon used for the calculation of benefits and costs is 50 years. (See also W80-00554) (Bell-Graf--Cornell)
W80-00563

ENGINEERING AND COST PARAMETERS,
Gates (W. E.) and Associates, Cincinnati, OH.
W. Grayman.
In: Applied Water Resource Systems Planning. Prentice-Hall, Inc., Englewood, Cliffs, New Jersey, p 149-174, 1979.

Descriptors: *Estimating, *Water resources development, *Alternative planning, *Engineering parameters, *Cost parameters, *Streamflow data, *Projects, Reservoirs, Irrigation, Data collections, Evaporation, Depth, Constraints, Simulation analysis, Screening model, Powerplants, Mathematical models, Systems analysis, Equations, Physical aspects, Structural aspects.

Described is the estimation of the engineering and cost parameters used in the series of three models employed to generate program alternatives for the Rio Colorado in Argentina. The chapter is divided into three sections; the first relates to streamflow data estimation and generation. The second section considers the estimation of physical and structural parameters of the potential projects in the basin,

including: reservoir area--depth and volume--depth curves; reservoir evaporation data; irrigation parameters; hydroelectric powerplant parameters; and upper bounds on project sizes. The final section deals with project cost estimates; considered are reservoir, powerplant, irrigation, and import and export costs. The parameter values given are presented in terms of the parameter notation used for the screening model and the basic simulation model developed for the Rio Colorado study. A short appendix written by D. Valencia and J. C. Schaake, Jr. follows this chapter, illustrating the streamflow augmentation procedure used in the study. (See also W80-00554) (Bell-Graf--Cornell)
W80-00564

SOCIO-ECONOMIC RELATIONSHIPS FOR WATER-BASED RECREATION INVOLVEMENT IN INDIANA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. T. O'Leary, and F. D. Dottavio.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-105125, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 125, September 1979. 71 p, 1 fig, 18 tab, 45 ref, 1 append. OWRT A-051-IND(3).

Descriptors: *Recreation demand, *Water sports, *Social participation, Recreation, Recreation facilities, Social aspects, Social impact, Economics, *Socioeconomic relationships, Water-based recreation, Recreation activity.

The research objectives were to determine who was participating in water based recreation in Indiana, examining profiles of the participants, and ascertain the change from 1972 to 1976. It was apparent that virtually all water recreational activities are done in groups of more than one. Yet most user data emphasized the individual visitor as the focal point. Social groups and age appear most promising in understanding involvement in water based recreation. Another facet of the research concentrated on activity clusters identified through factor analysis. Water activities tend to cluster in patterns. These patterns establish a basis for looking at the relationship between activities within a cluster (participants, profiles, resource needs, etc.) and between clusters. The process is being used on the 1977 Heritage Conservation and Recreation Service National Outdoor Recreation Survey of the general public at national and regional levels to examine clustering of activities.
W80-00636

APPLICATION OF GEOSCIENTIFIC KNOWLEDGE TO EVALUATION OF LAND AND WATER RESOURCES IN SOME DESERT AREAS OF EGYPT,
Egyptian Desert Inst., Cairo.
A. A. Shata.
Advances in Desert and Arid Land Technology and Development, Vol. 1, Adli Bishay and Wm. G. McGinnies, eds. Harwood Academic Publishers, 1979, p 183-200, 18 fig.

Descriptors: *Egypt, *Hydrography, *Geohydrologic units, *Geochemistry, *Structural geology, Land resources, Water resources development, Arid lands, Economic analysis, Balance of nature.

Over the past 20 years certain desert areas of Egypt have been considered for agricultural development either through use of available groundwater and surface runoff water or of Nile water. Accordingly, the available natural resources of these areas are evaluated here through the application of geoscientific approaches including hydrostratigraphy, hydrostructure, hydrology and hydrogeochemistry. While field and laboratory investigations have brought to light much information about the potentials of both water and land resources in the Mediterranean Littoral Zone, the fringes of the Nile Delta, the Sinai Peninsula, the Western Desert Depressions, the High Dam Lake fringes and the Red Sea- Gulf of Suez Foreshore Areas, it is emphasized that (1) water and land resources are available in almost all these areas but for agricultural development there is need to consider the ecological balance and the economics of development, and (2) cooperation between research institutions and development organizations must be strengthened in order to help solve immediate problems. (Tickes-Arizona)
W80-00639

WATER RESOURCES AND LAND RECLAMATION IN EGYPT,
General Co. for Research and Groundwater, Cairo (Egypt).
M. M. Seddik, and S. Shafei.
Advances in Desert and Arid Land Technology and Development, v. 1, Adli Bishay and Wm. G. McGinnies, eds. Harwood Academic Publishers, 1979. p 201-210, 4 tab.

Descriptors: *Water resources development, *Egypt, *Comprehensive planning, *Groundwater availability, *Water supply, Water utilization, Land reclamation, Land management, History, Rainfall, Runoff, Irrigable land, Irrigation water.

The development and utilization of Egypt's water resources, including Nile water, groundwater, and rainfall are discussed here in relation to the horizontal expansion of land in Egypt from the 19th century to present. An analysis of this expansion, summarized and traced here in terms of the period before 1900, 1900-1920, 1920-1964, and 1964-1972, indicates that today an estimated 25 million cu. m/year of groundwater is available, sufficient for the irrigation of 5000 feddans of olives, almonds, and fig trees along with rainfall and runoff sufficient for 135,000 feddans yearly. (Trickes-Arizona)
W80-00643

LARGE ARRAY OF WASTEWATER REUSE OPTIONS FOR PIMA COUNTY, ARIZONA,
Army Corps of Engineers, Los Angeles, CA.
M. F. Thuss.
Pima Association of Governments, 208 Project, Element 6, Task 6340, May 1978. 86 p, 12 fig, 30 tab, 11 ref.

Descriptors: *Water reuse, *Waste water disposal, *Waste water treatment, *Planning, *Project planning, *Regional analysis, *Competing uses, Water utilization, Reclaimed water, Alternative planning, Comprehensive planning, Water allocation(Policy), Irrigation water, Industrial water, Municipal water, Recreation, Drainage area, Water quality, Water supply, Pima County, Arizona.

The Pima Association of Governments 208 project's land use, economic and population projections along with the water use rates developed in Task Reports 6320 and 6330 are used in this analysis to identify sources of wastewater for irrigation, industrial, municipal, and recreational reuse in the Ajo Area, the Avra and Altar Valley Area, the Upper and Lower Santa Cruz area and the Upper and Lower San Pedro area. With the purpose of identifying a wide range of wastewater reuse options those potential sources are identified and discussed in terms of their volume, quality and location requirements. As the first step in developing a preferred plan for wastewater reuse in Pima County, Arizona this report examines current reuse practices, public opinion trends, reuse programs outside Pima County and proposed uses in an attempt to provide both the necessary background information and a preliminary analysis of all alternatives investigated. (Tickes-Arizona)
W80-00646

PROJECTED WATER USE AND WATER BUDGET CALCULATIONS FOR PIMA COUNTY, ARIZONA,
Army Corps of Engineers, Los Angeles, CA.
M. F. Thuss.
Pima Association of Governments, 208 Project, Element 6, Task 6330, Future Water Use Overview, April 1978. 69 p, 25 tab, 3 fig, 8 ref.

Descriptors: *Water utilization, *Hydrologic budget, *Water supply, *Competing uses, *Forecasting, *Alternate planning, Irrigation water, Municipal water, Industrial water, Recreation, Regional analysis, Drainage area, Return flow, Pumping, Recharge, Planning, Comprehensive planning, Pima County, Arizona.

Based upon the water supply and demand estimates established in The Water Supply Overview (Task Report 6310) and The Water Use Overview (Task Report 6320), an attempt is made here to calculate the present and future water budgets for Pima County, Arizona. Both historic and current agricultural, municipal, industrial and recreational water use is reported for the Ajo, Avra and Altar Valley, Upper and Lower Santa Cruz and Upper and Lower San Pedro areas and analyzed to determine the following rates of use: pumpage, return flow, recharge, flows and consumption. Once future water use projections are made they are compared with water supply information to establish water budgets for the projected planning period. It is concluded that the water budget for Pima County indicates an overall decline in annual water consumption from 337,900 acre-feet in 1975 to about 173,900 acre-feet in 2000 based upon the main assumption that cropped acreage will decrease from over 55,000 acres in 1975 to about 10,600 acres in 2000. It should be noted that at no time does dependable supply equal or exceed consumption and that these calculations do not consider the effects of water importation, conservation or wastewater reuse programs. (Tickes-Arizona)
W80-00647

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WORLD BANK: PRICING AS A MEANS OF CONTROLLING THE USE OF WATER RESOURCES.
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 2, p 659-668.

Descriptors: *Economics, *Pricing, *Water conservation, *Water demand, *Water supply, *Water utilization, Regulation, Water resources, Policy, Hydroelectric power, Irrigation, Municipal water, Water pollution control, Water management(Applied), Marginal costs, Alternative planning, Economic efficiency, Equity, Resource allocation, Costs.

Water pricing policies which reflect real resource costs incurred as a result of additional consumption rather than of historical costs associated with supply of water-related services, can prevent wasteful use of scarce water resources. This paper discusses pricing in regard to: (1) hydroelectric power, (2) municipal water supply, (3) irrigation, and (4) water pollution control. Common to pricing of all of these uses is resolution of conflicts among various objectives of pricing policy. Relevant costs are the value of the water resources which are made unavailable for other purposes because of that specific use. Costs of future systems expansion are important, while sunk costs are irrelevant. Engineering cost estimates, not historical accounting costs, are required. Real costs should be reflected in the charges which affect user choices, requiring: (1) low charges when additions to capacity can be provided cheaply, (2) an incentive to reduce industrial effluent strength when this would produce savings in treatment, and (3) a greater incentive to reduce water or electricity consumption in summer if capacity and costs are tied to summer use. The role of pricing stressed here is that of influencing consumer behavior to reduce wasteful water use or to achieve water conservation. Estimation of incremental costs is an important element of water resources management, useful either as a basis for establishing price or as a benchmark with which to evaluate social or other goals. (Lynch-Wisconsin)
W80-00411

WORLD BANK: AN APPROACH FOR SELECTION OF LABOUR VS. CAPITAL INTENSIVE TECHNOLOGIES FOR WATER RESOURCE DEVELOPMENT PROJECTS.
In: Water Management and Development, Pro-

ceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 669-684.

Descriptors: *Methodology, *Labor-intensive, *Capital-intensive, *Technology, *Design, *Employment, *Water resources development, Economic development, Developing countries, Project planning, Planning, Alternative planning, Economics, Civil engineering, Public works, Dams, Reservoirs, Irrigation canals, Unemployment, Underemployment, Equity, Trade-offs, Economic efficiency, Optimization, Labor, Capital, Analytical techniques, Income distribution, Resource allocation.

Labor-intensive construction can be economically efficient as well as technically feasible in public water resources development projects, such as dams, reservoirs, and irrigation channels, depending on: (1) technology employed, (2) project organization and management, (3) labor supply conditions, (4) health and nutrition of workers, and (5) project design. Most developing countries have problems of employment and underemployment in rural areas; civil works based on labor-intensive technology can help generate employment, while fostering economic development with distributional equity. For a given facility both technology and design should be regarded as variable rather than fixed, and for a given design the only relevant trade-off is the relative cost of capital-intensive or labor-intensive technology, assessed by social accounting prices if they diverge from market prices. Broadly speaking, in countries with wage rates less than US $1/day, labor-intensive methods can be fully competitive with modern equipment, provided the constraints mentioned above are satisfied. Proper organization and management capabilities are particularly important if efficient labor-intensive methods are introduced on a large scale. Great emphasis must be placed on the skill requirement and the institutional framework for project execution if labor-intensive methods are to be economical. Two case studies of labor-intensive irrigation projects are presented, for a major and a minor irrigation channel. (Lynch-Wisconsin)
W80-00412

RESTRICTION OF SUPPLY AND RISK IN WATER SUPPLY SYSTEMS,
Research Inst. for Water Resources Development, Budapest (Hungary).
M. Domokos, and S. Szabo.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1711-1732.

Descriptors: *Water supply, *Risks, *Economics, *Water demand, *Probability, Water management(Applied), Analytical techniques, Methodology, Optimization, Systems analysis, Mathematical studies, Mathematical models, Model studies, Marginal use, Equations, Incentives, Policy, Uncertainty, Planning, Estimating, Decision making, Irrigation, Hungary, Water supply restriction, *Water balance.

Rising costs of maintaining water supply systems has focused attention on restricting consumption rather than completely meeting peak demand. This paper analyzes monetary risks resulting from supply restrictions and from unused capacity. Where mathematical represention of actual systems or a lack of information create difficulties, the water balance is more appropriate than systems analysis, although not as reliable. In the water balance, the water resources situation within a particular unit is described by a single index number representing marginal use, the supply restriction number. The situation is considered acceptable if the index is smaller than the limit value (the water shortage tolerance) specified by economic considerations. There are three types of coincidence between available resources and demand: (1) demand is constant, (2) there is an acceptable deterministic functional relationship between the two variables, or (3) the coincidence is stochastic, describable by a joint relative frequency function. Risk estimation by probability theory is the logical choice for economic activities subject to hydrological effects. Computation of risk indices is based on simulated time series of the operational model of the water supply system. A risk fund is needed to compensate losses. Application to a Hungarian irrigation water supply project is described. (Lynch-Wisconsin)
W80-00442

WATER FOR DOMESTIC USE IN RURAL AREAS - THAILAND,
Department of Public Works, Bangkok (Thailand). Rural Water Supply Div.
For primary bibliographic entry see Field 6D.
W80-00448

6D. Water Demand

WATER FOR AGRICULTURE.
Food and Agriculture Organization of the United Nations, Rome (Italy).
For primary bibliographic entry see Field 4A.
W80-00424

REPORT ON COMMUNITY WATER SUPPLIES,
World Health Organization, Geneva (Switzerland).
For primary bibliographic entry see Field 5F.
W80-00427

WATER FOR THE THOUSAND MILLIONS,
Intermediate Technology Development Group, London (England).
For primary bibliographic entry see Field 6A.
W80-00432

WATER FOR DOMESTIC USE IN RURAL AREAS - THAILAND,
Department of Public Works, Bangkok (Thailand). Rural Water Supply Div.
L. Chainarong.
In: Water Management and Development, Proceedings of the United Nations Water Conference, Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1835-1846.

Descriptors: *Thailand, *Rural areas, *Domestic water, *Water supply development, *Pipelines, *Financing, *Planning, Regional planning, Developing countries, Wells, Pumps, Use rates, Meters, Costs, Design criteria, Training, Institutions, Administrative agencies, Governments.

Thailand's rural water supply program will provide a safe domestic water supply for the entire rural population of some 32 million, 77% of the total Thai population. To date, water systems have been provided for about 17% of the rural population (communities of under 5000), and a goal of 25% has been set for 1980 focusing on smaller communities. Planning, implementation, and financing are responsibilities of several government agencies. Liaison is maintained through a National Committee composed of representatives from each implementing agency, the National Planning Agency, and the Budget Bureau. Water systems include piped systems, deep tube wells (80-100 m), tube wells with hand pumps, small-diameter shallow tube wells, and rainwater storage tanks. For piped systems construction costs are jointly financed by the national and local governments while tube wells and hand pumps are financed in full by national government subsidies. In areas with piped systems, consumers are required to pay for the water at a fixed monthly rate per household, and householders also pay for the water outlet. Water meters introduced experimentally in selected areas for house connections are well-received, facilitate water rate collection, ensure regular minimum operating funds, and reduce wastage of water and plant operation. Training courses are conducted for water and treatment plant operators, and assistance from international organizations has been received. (Lynch-Wisconsin)
W80-00448

ISRAEL- A MODEL OF EFFICIENT UTILIZATION OF A COUNTRY'S WATER RESOURCES,
Ministry of Agriculture, Tel-Aviv (Israel).
For primary bibliographic entry see Field 6E.
W80-00471

U.S. INLAND WATER TRANSPORTATION,
Department of Transportation, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-00473

INTER BASIN WATER TRANSFERS IN SOUTH AFRICA,
Department of Water Affairs, Pretoria (South Africa),
T. P. C. Van Robbroeck.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2563-2582.

Descriptors: *South Africa, *Water transfer, *River basins, *Water supply development, *Dams, Rivers, Reservoirs, Water storage, Water shortage, Municipal water, Powerplants, Orange River (South Africa), Fish River (South Africa), Sundays River (South Africa), Tugela River (South Africa), Vaal River (South Africa), Irrigation, Pumping, Pipelines.

Large-scale inter-basin transfer of water can correct geographic imbalances between water supply and demand. This paper describes several projects for water transfer in South Africa, primarily: (1) the Tugela Vaal project, (2) eastern Transvaal coal-fields water supply, and (3) the Orange-Fish-Sundays diversion. Projects mentioned briefly are Vaal-Gamagara, Springbok, and Theewaterskloof; several other are in palnning. Exploitable water in South Africa is poorly distributed. By the late 1960s in the Pretoria-Witwatersrand-Vereeniging complex (population 4.5 million) the Vaal and Bloemhof Dams could not meet future demands, and it was decided to import water from the neighboring Tugela River catchment via storage in the Sterkfontein Dam, a specially constructed reservoir. In the eastern Transvaal coal fields, water had to be imported from the Komati catchment to cool a large pit-head coal-fired power station; water in the area of the station is scarce. A regulating dam was built to a capacity of 84 million cu m. When additional power stations were built another dam was constructed further down the river. A 1962 plan for development of the Orange River included a proposal to divert 849 million cu m/yr of water via a tunnel to the Fish and Sundays Rivers for irrigation and water supply. (Lynch-Wisconsin)
W80-00483

WATER USAGE PROFILE-FORT CARSON CO.,
Construction Engineering Research Lab. (Army), Champaign, IL.
J. E. Matherly, N. J. Staub, L. J. Benson, and R. J. Fileccia.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A053 227, Price codes: A04 in paper copy, A01 in microfiche. Interim Report N-34, March 1978. 57 p, 6 tab, 1 append.

Descriptors: *Military reservations, *Water demand, *Irrigation, *Domestic water, *Fort Carson, Colorado, Water conservation, Water utilization, Irrigation water, Current meters, Water measurement, Lawns, Water users, Irrigation practices, Water rates, Colorado Springs(CO).

Family housing water usage (600 gal capita d) at Fort Carson military installation, Colorado, greatly exceeds normal family housing water usage of 50-100 gal capita d. Based on limited on-site observations, the unexpectedly high average daily water usages reflect extensive lawn and garden irrigation. Fort Carson water usage increased from 2.71 mg d in 1970 to 3.68 mg d in 1976. Much of the 36% increase results from several family housing units constructed between 1971 and 1974. The study's

objectives were to provide current Fort Carson water usage data, evaluate it, and appraise monitoring data acquisition techniques. Barracks, family housing units, commercial, industrial, and recreational facilities at Fort Carson were equipped with water meters and data collection continued from March to July, 1977. Fort Carson is probably unique in the large amounts of domestic water used for irrigation. Information on civilian water demands in nearby Colorado Springs must be compared with Fort Carson water demands. Current manual data collection methods are satisfactory; however, automated methods will be required to obtain more continuous data. (Danovich-Wisconsin)
W80-00494

URBAN RESIDENTIAL DEMAND FOR WATER IN THE UNITED STATES,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
H. S. Foster, Jr., and B. R. Beattie.
Land Economics, Vol. 55, No. 1, p 43-58, February 1979. 3 fig, 4 tab, 27 ref.

Descriptors: *Water demand, *Water users, *Model studies, Water allocation(Policy), Water distribution(Applied), Economics, Water management(Applied), Water policy, Water requirements, Water supply, Water utilization, Water rates, Income analysis, Social aspects, Rainfall, Seasonal, Domestic water, Residential use, Cities.

It is argued that a general urban residential water demand model applicable to the entire continental U.S. can be formulated and that such demand may be estimated using price, rainfall, income and population per water meter as independent variables. This study specifies and estimates parameters for an improved Fourt-type model of demand. Fourt's (1958) method was based on two models. The first included price, number of summer rainfall days and average number of persons served per meter. The second model used price, per-capita income and percentage of dwellings comprising three or more habitation units. The model tested in this study improves on the Fourt models by combining the most useful parameters from each and omitting irrelevant or improperly specified variables. The new model is stated as $Q=f(P,Y,R,N)$. Q represents quantity of water per household, i.e., per meter (1000 c ft yr); P is average water price (dollars per 1000 c ft); Y is median household income (dollars yr); R is precipitation (inches) during defined growing season; and N is average number of residents per water meter. Each parameter was separately tested for statistical fit against empirical data, and elasticity estimates of the overall model compared favorably with those of previous studies made of separate U.S. geographic regions. (Harris-Wisconsin)
W80-00495

LONG-TERM AVAILABILITY OF WATER RESOURCES FOR ENERGY DEVELOPMENT IN THE CENTRAL UNITED STATES,
Argonne National Lab., IL. Energy and Environmental Systems Div.
L. J. Habegger, S. Y. Chiu, and L. J. Hoover.
Prepared for 5th National Conference on Energy and the Environment, Cincinnati, Ohio, October 31-November 3, 1977. 6 p, 1 fig, 1 tab, 3 ref.

Descriptors: *Water demand, *Water utilization, *Energy, *Central US, *Electric powerplants, Water policy, Water allocation(Policy), Great Lakes Region, Great Plains, Planning, Irrigation, Competing uses, Water consumption, Electric power demand, Water shortage.

Cumulative water supplies are adequate in the Central U.S. region to satisfy energy requirements and other uses, but some subregions exist in which moderate to severe water shortages are likely. The overall region includes the Great Lakes, Mississippi River and its tributaries, the Ohio, Missouri, Illinois, and Arkansas Rivers. Total regional energy demand has been forecast to double every 35 years, although growth rate has declined. Total energy-related water consumption is estimated at 2,044 cfs for 1985, 4,410 cfs for 2000, and 11,700 cfs for 2020; existing plants use 835 cfs. Estimates include fossil and nuclear power plants and synfuel plants. Total water consumption by existing competing withdrawal users was 38,000 cfs in 1975 and is expected to increase to 43,000 cfs by 1985, 47,000 cfs by 2000, and 55,000 cfs by 2020. Irrigation is the largest water demand, consuming more than 70% of the 1975 regional total. About 77%, or 9,000 cfs of the 2020 year total regional energy development water requirement could be obtained without creating major water shortages for other users. Water shortages are potentially so severe in Arkansas River Basin in Kansas and Platte River Basin in Nebraska that siting energy facilities are prohibitive unless drastic measures are used, such as interbasin transport, limiting other users' allocation, or dry cooling. Regional energy and water resources planning integration is essential. (Danovich-Wisconsin)
W80-00499

PLANNING STATUS REPORT, WATER RESOURCES APPRAISALS FOR HYDROELECTRIC LICENSING: LOWER ARKANSAS RIVER BASIN-ARKANSAS, COLORADO, KANSAS, NEW MEXICO, OKLAHOMA AND TEXAS,
Federal Energy Regulatory Commission, Washington, DC. Office of Electric Power Regulation.
Revised 1979. 17 p, 2 fig, 7 tab. DOE/FERC-0034.

Descriptors: *Water resource planning, *Water resource development, *Water projects, *Hydroelectricity, *Reservoir projects, *Arkansas River Basin, *Multiple purpose projects, Planning, Reservoirs, Dams, Water quantity, Inter-basin transfers, Water supply, Governments, Water supply development, Feasibility studies.

This is one of several revised Planning Status Reports for major river basins of the United States. Encompassing six south central and western states, the Lower Arkansas River Basin covers 104,389 square miles, and ranges in elevation from 8,000 feet in New Mexico to 100 feet at the Mississippi River confluence. The basin's rainfall varies from abundant in the east to arid in the west. The area has extensive natural resources, most notably petroleum and gas. The 1971 population totaled approximately 3,100,000. Fifty-six reservoirs are either in place or under construction in the basin; seven existing hydroelectric projects in the lower portion of the basin total 588,000 kilowatts of capacity. Steam electric capacity for the basin is projected to be about 17,124, 000 kilowatts (KW) by 1985, with 30% of this being nuclear power, and 40,394,000 KW by the year 2000, with 54% being nuclear power. Current planning efforts are directed toward improved flood control, construction of multi-purpose projects, and trans-basin water conveyance from the basin to more arid regions. No hydroelectric projects have been approved for the basin, but potential hydroelectric and thermal generating projects are presented. (Arnold-NC)
W80-00533

WATER SUPPLY FOR URBAN AREAS: PROBLEMS IN MEETING FUTURE DEMAND,
Comptroller General of the United States, Washington, DC.
Report No. CED-79-56, June 15, 1979, 50 p, 1 append.

Descriptors: *Water supply, *Water resources management, *Water use, *Water quantity, *Water demand, *Water resources, Water resources development, Water policy, Water reuse, Water consumption, Groundwater, Desalination, Conservation, Water supply development, Supply, Interbasin transfers.

This study outlines and analyzes urban water supply/demand problems for the U.S. Increasing population and rising demand will mandate more stringent conservation measures with a projected U.S. population of 268 million by 2000. Of particular concern is the accelerating extraction of groundwater, particularly in the arid West. Discussions were held with Federal, State and local officials in developing this report. Findings include: less streamflow reliability in the future for Western cities, and increasing numbers of streams with supplies already fully allocated to local urban areas, and increased pollution of urban water from agriculture and mining. Distribution system problems are discussed and institutional and legal constraints are presented. Fourteen major urban areas were examined to determine what each was doing to assure an adequate future water supply. All areas projected the need for additional water supplies by 2000. Many have instituted only emergency measures, such as interbasin water transfers, to alleviate current problems. Such interbasin transfers may become the rule for most large urban areas for an interim period; no obvious solutions are in sight, but steps such as desalination, wastewater reuse, conservation, and some supply increase may be feasible. (Arnold-NC)
W80-00543

COLORADO RIVER BASIN WATER PROBLEMS: HOW TO REDUCE THEIR IMPACT,
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-00545

APPROPRIATIVE WATER RIGHTS AND EFFICIENT ALLOCATION OF RESOURCES,
New Mexico Univ., Albuquerque.
For primary bibliographic entry see Field 6E.
W80-00548

AN ANALYSIS OF RESIDENTIAL DEMAND FOR WATER USING MICRO TIME-SERIES DATA,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
L. E. Danielson.
Water Resources Research, Vol. 15, No. 4, p 763-767, August 1979. 3 tab, 24 ref.

Descriptors: *Water demand, *Residential, *Time series analysis, Statistical methods, Estimating, Seasonal, Sprinkling, Systems analysis, Equations, Price elasticity, Income elasticity, Econometric model, Raleigh(NC).

This paper presents the results of a study of a time series of cross-sectional observations on water demand at the household level utilizing an econometric model for pooled cross-section and time-series data. Checks for multicollinearity, serial correlation, and heteroskedasticity are made to insure that the methodology is consistent with the assumptions required for obtaining unbaised estimates of parameters and standard errors. Residential water demand is estimated as a function of temperature, rainfall, house value, water price, and household size using monthly meter readings from 261 residential households in Raleigh, North Carolina, between May 1969 and December 1974. Demand relations are estimated for total residential, winter, and sprinkling demands. Sprinkling use per period per customer for each year is estimated by subtracting winter (November-April) from summer (May-October) use. Household size explains the largest proportion of the variation in the data. Estimated sprinkling demand is found to be highly responsive to changes in water price and the level of the climatic variables, while total residential demand and winter demand are less responsive to price changes. (Bell-Graf--Cornell)
W80-00599

A COMPARATIVE ANALYSIS OF MULTI-SOURCE WATER SUPPLY DATA FOR PIMA COUNTY, ARIZONA,
Army Corps of Engineers, Los Angeles, CA.
M. F. Thuss.
Pima Association of Governments 208 Project, Element 6, Task 6310, Existing Water Supply Overview, April 1978. 152 p, 51 fig, 11 tab, 33 ref.

Descriptors: *Water supply, *Water yield, *Forecasting, *Hydrologic data, *Water resources development, *Water supply development, *Hydrologic budget, *Water utilization, *Regional analysis, Water yield improvement, Storage, Alternative planning, Comprehensive planning, Legal con-

straints, Water quality, Recharge, Pima County, Arizona.

An overview of the water supply data for Pima County, Arizona, is presented which centers on identifying the best estimates of the total amount of recoverable water in storage and the yearly dependable supply in 4 major areas of Pima County in an effort to establish the supply element for future budget calculations. While no attempt is made here to determine if an identified water supply potential can, in reality, be efficiently developed, the specific objectives of this overview report are: to identify and describe (1) previously published reports related to water supply in the study area, (2) areas which hold minimum potential for water supply development, (3) areas having potential for water supply development, (4) to determine and define legal and quality constraints to water supply development, and (5) to determine and define the most reasonable estimates of recoverable water in storage and natural average annual recharge for those areas having potential for water supply development. (Tickes-Arizona)
W80-00644

WATER WITHDRAWALS IN ILLINOIS, 1978,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W80-00722

6E. Water Law and Institutions

POLICY OPTIONS,
For primary bibliographic entry see Field 6A.
W80-00404

PRESENT AND FUTURE ACTIVITIES OF THE UNITED NATIONS SYSTEM IN WATER RESOURCES DEVELOPMENT.
For primary bibliographic entry see Field 6A.
W80-00405

WORK OF THE INTERNATIONAL LAW COMMISSION ON THE LAW OF THE NON-NAVIGATIONAL USES OF INTERNATIONAL WATERCOURSES.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 2, p 871-906.

Descriptors: *International waters, *International law, *River basins, *Lakes, *Water resources development, *International Law Commission, International cooperation, Treaties, Legal aspects, International commissions, United Nations, Environmental effects, Water pollution effects, Canals, Basins, Rivers, International relations.

Pursuant to a 1975 United Nations resolution requesting the International Law Commission to give priority to developing and codifying the law of the non-navigational uses of international watercourses, the Commission undertook such a study in the same year. This paper presents a brief introduction followed by two appendices: (1) Chapter V of the International Law Commission's report on its 28th Session (1976) pertaining to the study; and (2) the first report on the law of non-navigational uses of international watercourses. The first document recounts the deliberations of the Commission, and includes a review of issues, literature, precedents, member opinions, and treaties dealing with international waters. The second report discusses issues to be considered by the Commission prior to beginning substantive work. Among these issues: (1) definitions of international watercourse (such as rivers, canals, or lakes making up or crossing an international boundary), and non-navigational uses (pollution, floods, erosion, agricultural, economic, and commercial, cooling, domestic and social); (2) whether the starting point is the boundary concept with opposing sovereignties on either side, or the physical characteristics of water in which regulations of one power over such matters as water level control or pollution directly affect the other; (3) differences between watercourses which form a boundary and those which cross it; and (4) more than two states sharing a watercourse (the entire basin must be viewed as a unified whole). (Lynch-Wisconsin)
W80-00423

TECHNICAL COOPERATION AMONG DEVELOPING COUNTRIES WITH REGARD TO WATER RESOURCES DEVELOPMENT.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 3, p 943-952.

Descriptors: *Water resources development, *International cooperation, *Developing countries, *Technical cooperation, *Scientific personnel, United Nations, River basins, River basin development, Water management(Applied), Technology, Information exchange, Training, Education, Research and development, Planning, Financing, Regional planning, International commissions, International waters, Institutions.

A report to the 1977 United Nations Water Conference by the Ad Hoc Group of Experts on Technical Co-operation among Developing Countries in Water Resources Development focuses on need for: (1) an improved information base; (2) research, education, and training; (3) experts and consultancy services; (4) standardization of services and equipment; (5) planning and management problems; (6) financial aspects; and (7) actions at regional and interregional levels. Recommendations include: (1) inventory resources available in the countries involved, including research, educational, and training facilities, and experts and consulting services at the national, subregional, and regional level; (2) establish institutional arrangements for data exchange; (3) evolve and streamline procedures for offering and receiving cooperation among developing countries in research, education, and training related to water resources development; (4) establish a roster of experts, and provide financial and other incentives to induce them to work in other countries; (5) standardize technical terms and water structures; (6) formulate joint international programs for watershed management, inland navigation, flood forecasting and warning systems, integrated river basin development and management, and groundwater prospecting and development; (7) establish pools of construction plants and equipment; (8) utilize regional development banks and third-party financing; and (9) strengthen the U.N. Regional Commissions to enable them to promote technical cooperation. (Lynch-Wisconsin)
W80-00425

WATER LAW AND LEGISLATION: HOW TO USE THEM TO OBTAIN OPTIMUM RESULTS FROM WATER RESOURCES,
International Association for Water Law.
G. J. Cano.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 3, p 993-1016.

Descriptors: *Water law, *Legislation, *Water policy, *Water resources, *Water supply, *Methodology, Legal aspects, Hydrologic cycle, Water rights, Water users, Water utilization, Land tenure, Administration, Regional development, Arid lands, Optimization.

A methodology for using water legislation as a tool for carrying out water policies draws on conclusions and recommendations of two international water law conferences and on a document prepared by the Economic Commission for Asia and the Far East. Subjects discussed: (1) drafting water laws, (2) role of policy-making and legislative authorities and the role of users, (3) content of water laws, (4) the hydrological cycle and water law consolidation, (5) legal codes, (6) legislative methodology, (7) reasons why many water laws impede rather than promote optimum water use, (8) trends in water law modernization, and (9) water legislation as a policy instrument in other areas, such as location and size of communities, regional integration, land distribution and tenure in dry areas, zoning, food production, and environmental policy. Water legislation must deal with four relationships: (1) person-person, (2) person-water, (3) government-person, and (4) within the government. Laws should cover water policy, data gathering, water ownership and control, rights acquisition, restrictions on sources of uses, priorities, use conditions, rights of nonusers, protection against harmful effects of water, judicial aspects, administration, registration and classification of water and uses, and approval of new use techniques. General faults of water law include uncertainty, rigidity, incompleteness, lack of realism, lack of functional coordination, inter-jurisdictional problems, poor administrative coordination, and use- rather than resource-orientation. (Lynch-Wisconsin)
W80-00428

THE DESIGN AND EVALUATION OF INSTITUTIONAL ARRANGEMENTS FOR WATER PLANNING AND MANAGEMENT,
Colorado Univ., Boulder. Dept. of Economics.
C. W Howe.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 3, p 1063-1104.

Descriptors: *Institutions, *Planning, *Water management(Applied), *Design criteria, *Evaluation, *Administrative agencies, Governments, Institutional constraints, Water policy, Political constraints, Botswana, Israel, Hungary, Indonesia, Iran, Argentina, Soviet Union, East Germany, Pakistan, Tanzania, United Kingdom, Brazil, India, Mexico, France, Spain, Canada, United States.

Institutional structures for water planning and management in 18 countries is analyzed. Factors contributing to effective institutional design and evaluation are identified. Issues determining water planning and management performance include: (1) basic water laws and traditions; (2) organizational structure; (3) arrangements for coordinating water agencies among themselves and with other sectors; (4) arrangements for linking technical water planning and management to political decision-makers at the local and national level through two-way information flows; and (5) arrangements for funding of planning, research, construction, and operations. Organizational structures of the 18 countries are presented in outline form, showing agencies and their responsibilities. Countries are grouped by size and whether organization is centralized, decentralized, or coordinated decentralized. Countries: Botswana, Israel, Hungary, Indonesia, Argentina, Iran, Soviet Union, East Germany, Pakistan, Tanzania, United Kingdom, Brazil, India, Mexico, France, Spain, Canada, and United States. Institutional arrangements taken from these outlines are then summarized in a series of outlines according to the issues listed above, grouped by degree of centralization. Nine criteria are given for evaluating institutional performance; among them are information generation, responsiveness to externalities and priorities, expeditiousnes, economic efficiency, review, initiative, and future planning. (Lynch-Wisconsin)
W80-00431

POLICY AND ORGANIZATION OF WATER RESEARCH IN THE UNITED KINGDOM.
For primary bibliographic entry see Field 6A
W80-00439

ENVIRONMENTAL ASPECTS OF POLLUTION CONTROL IN HUNGARY.
Research Inst. for Water Resources Development, Budapest (Hungary)
For primary bibliographic entry see Field 6A.
W80-00441

WATER LAW AND ITS APPLICATION IN POLAND,
Ministry of Agriculture, Warsaw (Poland).
S. Surowiec, and A. Deja.
In: Water Management and Development, Proceedings of The United Nations Water Confer-

ence; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 1737-1744.

Descriptors: *Poland, *Water law, *Water management(Applied), *Permits, *Regulation, *Water utilization, *Ownership, *Socialism, *Water rights, Legislation, Legal aspects, Water supply, Water resources development, Planning, Administration, Governments, Irrigation, Jurisdiction.

The Polish Water Law of 1974 amplifies the water law of 1962, which replaced that of 1922; the current regulations tie basic legal institutions to the socialist economy based on planned management and control. Because of scarce water resources and rapidly rising demand, the 1974 law stresses water resources development planning. Basic legal concepts cover water ownership and utilization. Flowing waters and groundwater (except wells) are state property, while stagnant and ditch waters and wells are the property of the landowner. Ownership of land under flowing waters belongs to the water owner, whereas ownership of nonflowing water follows land ownership. The water license is the basic legal instrument for controlling water utilization. Disputes regarding compensation connected with water licenses are resolved by administrative authorities which issue the licenses, thus usually eliminating court delays and costs. The administrative authorities also have jurisdiction over disputes involving delimitation of land covered by surface water, embankment cost-sharing, and redistribution of water surplus. The law recognizes three forms of water utilization: (1) public, (2) normal (or private), and (3) specific. Only the third requires a license. The licenses protect both the interests of other parties affected by the utilization, and the national interest. The law also regulates pollution and flood control, reservoirs, and irrigation, and provides for charges for consumption and waste disposal. (Lynch-Wisconsin)
W80-00443

RIVER BASIN MANAGEMENT IN THE UNITED KINGDOM.
Department of the Environment, Reading (England). Central Water Planning Unit.
For primary bibliographic entry see Field 6A.
W80-00449

THE LONG-TERM NATIONAL PROGRAMME FOR RIVER BASIN DEVELOPMENT, BASIS OF THE WATER MANAGEMENT POLICY IN ROMANIA,
For primary bibliographic entry see Field 6A.
W80-00450

FINNISH EXPERIENCES IN WATER-RESOURCES PLANNING AND MANAGEMENT POLICY,
National Water Board of Finland, Helsinki.
For primary bibliographic entry see Field 6A.
W80-00451

EXPERIENCES IN JOINT ADMINISTRATION OF BORDER WATERCOURSES,
For primary bibliographic entry see Field 6A.
W80-00452

SWEDISH POLICY FOR WATER QUALITY PROTECTION,
National Swedish Environment Protection Board, Stockholm.
A. Hanson.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 1965-1979.

Descriptors: *Sweden, *Water policy, *Water pollution control, *Administration, *Financing, *Law enforcement, Legislation, Effluents, Industrial wastes, Municipal wastes, Wastewater treatment, Technology, Water conservation, Permits, Grants, Administrative agencies, Institutions, Water purification, Problem identification and ranking.

Legislative, administrative, technological, and financial aspects of water quality control in Sweden are discussed. A permit system was established in the late 1930s to control effluent discharges, strengthened by the Environment Protection Act of 1969. Permits are now awarded by the National Franchise Board for Environment Protection, a cornerstone of national water conservation policy. An appendix enumerates activities subject to prior assessment. The absence of specifications and standards and promotion of individual assessment has accelerated technological development of protective measures. To control abuses of water-polluting industries in their relationships with municipal wastewater networks, a double assessment procedure was adopted in which measures required of the industry are determined and sanctions are imposed or withheld to ensure compliance. The government controls siting of polluting industries. The primary enforcement authority is the National Environment Protection Board. Centralization of administration has expedited pollution control and resulted in uniformity of operation and policy and in rapid problem identification. Government and industry have cooperated closely in environmental protection, including the joint Institute for Water and Air Pollution Research. Chemical purification is the standard for municipal wastewater treatment, supplemented by filtration in sensitive systems. For industry, processing and structural modifications have been used. Government grants have been a powerful control instrument. (Lynch-Wisconsin)
W80-00454

TOXIC SUBSTANCES IN WATER--THE U.S. EXPERIENCE.
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5G.
W80-00456

WATER RESOURCES DEVELOPMENT, AND MANAGEMENT PLANNING IN ARID ZONES: CASE HISTORY-ISRAEL,
Tahal Consulting Engineers (Israel).
For primary bibliographic entry see Field 6A.
W80-00457

ESTABLISHMENT OF QUALITY CRITERIA FOR WATER USE IN AUSTRALIA,
Caulfield Inst. of Tech., Victoria (Australia). Water Studies Centre.
B. T. Hart.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2089-2106.

Descriptors: *Australia, *Water quality criteria, *Water management(Applied), *Water pollution control, *Planning, Water quality standards, Governments, Water policy, Methodology, Water utilization, Environmental effects, Toxicity, Bioassay, Ecosystems, Recreation, Agricultural runoff, Industrial wastes, Pollutants.

In 1970 attention in Australia was focused on water pollution by release of a governmental report, Water Pollution in Australia, and by introduction of environmental legislation in several states. This pointed up the need for quality criteria on which to base assessments of short- and long-term effects of pollutants. To partially meet this need, a Compilation of Australian Water Quality Criteria was commissioned, published in 1974. The present paper deals with: (1) preparation of the criteria document, (2) uses of water quality criteria, (3) development of water quality standards, (4) criteria and environmental planning, (5) use of criteria in developing a water management strategy, and (6) updating criteria. In contrast to standards, which constitute legally enforceable levels and include a water use classification and a plan for implementation and enforcement, a criteria document involves data collection followed by estimation of safe exposure levels relative to uses of a water body. Criteria provide: (1) an assessment of short- and long-term effects of a pollutant at any concentration, (2) scientific information for natural resource use and environmental planning, and (3) necessary data for establishing water quality standards. Examples are given to illustrate these uses, and a methodology is described which was used to develop a water quality strategy for the Albury-Wodonga area. The 1974 document contains criteria related to domestic water supplies, preservation of aquatic ecosystems, agriculture, industry, and recreation. (Lynch-Wisconsin)
W80-00460

INTER-STATE RIVERS IN AUSTRALIA,
Melbourne Univ., Parksville (Australia).
S. D. Clark.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2109-2120.

Descriptors: *Australia, *Murray River(Australia), *Darling River(Australia), *Interstate rivers, *Interstate commissions, *Water rights, Water law, Rivers, Judicial decisions, Legislation, Tributaries, Irrigation, Water supply, Legal aspects, Navigation, New South Wales(Australia), Victoria(Australia), South Australia, Federal government, History, River Murray Waters Agreement, History, Institutions, Administrative agencies, River basin development, Arid lands, River basin commissions.

With reference to current efforts to revise and strengthen Australia's River Murray Waters Agreement of 1914, this paper traces the background of Australian constitutional and legal history, disputes among New South Wales, Victoria, and South Australia over use of the Murray-Darling River system, and provisions of the original agreement. The Murray-Darling system, has generated difficult water disputes and profoundly influenced distribution of power by the federal government and states. Though the river system drains about one-seventh of the country, its average annual flow is very small. Extreme flow variability exacerbates use of Australia's water resources; an extreme example is the Darling, the Murray's longest tributary, which varies from 1230 to 13.5 million cu m/yr. Irrigation in Australia requires more than twice as much storage to even out flow as in the United States. The River Murray Waters Agreement sought to: (1) lay down a mutually agreeable program of locks and storages, (2) apportion financial and building responsibilities, (3) establish navigation tariffs, (4) develop a formula for determining the volume of water each upstream state can withdraw and the amount of compensation water allowed to flow to South Australia, and (5) permit water to be released for saline dilution flows. Administration was vested in the River Murray Commission, composed of representatives of each state and the federal government, but it was given very little independent power. The new government would broaden the Commissions functions but stop short of granting it coercive powers. (Lynch-Wisconsin)
W80-00461

ON ROLE OF ADMINISTRATIVE, ECONOMIC AND TECHNOLOGICAL MEASURES IN PROTECTION OF SURFACE AND SUBTERRANEAN WATER AGAINST CONTAMINATION AND DEPLETION,
All-Union Scientific Research Inst. for Protection of Waters (USSR).
V. R. Lozansky, A. K. Kuzin, and I. D. Pichakhchi.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2179-2194.

Descriptors: *Soviet Union, *Planning, *Water pollution control, *Water resources, *Economics, *Administration, *Technology, Legal aspects, Administrative agencies, Governments, Water policy, Surface waters, Subsurface waters, International cooperation, Watersheds(Basins), Point pollution, Nonpoint pollution, Socialism, Central planning.

The Soviet Union's planned economy controls all activities pertaining to protection of surface and subsurface waters, and integrates material, labor,

and monetary resources for control efforts. Programs can be geared to basins or branch of industry. Central planning ensures proportional development of technological, administrative, economic, and legal measures. Technological measures include: (1) transition to waterless methods of production, (2) development of efficient and economically feasible treatment methods for effluents and urban and agricultural surface runoff, and (3) automation of water protection. The most important administrative measure was creation of a national water management agency, responsible for monitoring implementation of water protective measures, discharge of effluents, and treatment plant operations. The agency is organizing and overseeing a national planning program. Economic measures involve: (1) preferential credit terms for water protection plans, (2) introduction of payments for water usage and effluent discharge, and (3) fines for pollution. National and international legal documents can contribute significantly to water protection. For water bodies shared by several countries, international commissions could assist in solving general problems of water protection and allot water usage on the basis of optimization modelling and international law. (Lynch-Wisconsin)
W80-00465

EXAMPLES OF THE ORGANIZATION OF SELF-ADMINISTRATION IN THE WATER ECONOMY OF THE FEDERAL REPUBLIC OF GERMANY,
Ruhrtalsperrenverein, Essen (Germany, F.R.).
F. Bergmann.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata,Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2267-2274.

Descriptors: *Ruhr District(West Germany), *Water management(Applied), *Sewage treatment, *Water supply, *Ruhr Valley Association(West Germany), *Ruhr Authority(West Germany), *Administrative agencies, River basins, River basin commissions, Sewage disposal, Waste water treatment, Industrial wastes, Municipal wastes, Institutions, West Germany, Water pollution control, Financing, Regional planning, Regional development.

The Ruhr Valley Association is responsible for water supply and the Ruhr Authority for water quality (especially sewage treatment) in West Germany's heavily industrialized and densely populated Ruhr District. Both are good institutional examples of industrial and public cooperation in long-term regional water management. They were created in 1913 by public law with self-administration, but subject to government supervision. Associate members of the authority are all entities polluting the Ruhr Basin, including local authorities, industrial and business enterprises, and water consumers belonging to the valley association. Members of the latter are owners of water works and other facilities which remove over 30,000 cu m of water from the basin annually. Organization of the two agencies is similar. General meetings of members and boards elect board members and pass judgment on budget plans and assessment principles. Number of votes per member depends upon contribution. The same person usually is chairman in both groups. Construction, maintenance, and operation costs are covered by member contributions, assessed according to members' benefits and costs. Between 1948-75 the Association spent 660 million DM on reservoirs and the Authority 380 million DM for building expenses. Fourteen reservoirs store water for dry periods, which is supplied to the rivers to increase flow rate and improve water quality. (Lynch-Wisconsin)
W80-00470

ISRAEL- A MODEL OF EFFICIENT UTILIZATION OF A COUNTRY'S WATER RESOURCES,
Ministry of Agriculture, Tel-Aviv (Israel).
S. Arlosoroff.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 4, p 2283-2334.

Descriptors: *Israel, *Water resources development, *Arid lands, *Water conservation, *Water supply development, *Water management(Applied), Water utilization, Legal aspects, Administration, Agriculture, Irrigation, Industrial water, Economic development, Financing, Water shortage, Legislation, Groundwater, Saline water intrusion, Water policy.

Carefully managed scarce water resources in Israel since 1948 has enabled successful development of agriculture and industry in an arid region and has permitted unusually high population growth. Israel's experience demonstrates necessity for full use and coordination of legislation, administration, research and technological innovation, instruction, and extension services. This paper covers: (1) background on geography, climate, water resources, water policy, special constraints, and nonconventional water sources; (2) legislation and administration; (3) and efficient water use in agriculture, the domestic sector, and industry. Total usable water resources amount to about 1700 million cu m/yr, only slightly greater than current requirements. Groundwater and springs account for 60% of total water, surface water 25% (mainly in the Jordan watershed), and flash floods 5%. Extensive coastal groundwater supplies must be withdrawn sparingly to prevent seawater intrusion. Large-scale desalination has been postponed to await economic and technological justification. Principal water resources are located in the extreme northeast. while demand is concentrated in the center and south. To best use the limited water, government policy encourages reuse of effluent in agriculture and industry; water pollution control consequently is a major concern. The national water carrier, completed in 1964, conveys about 350 million cu m/yr from the Lake Kinneret southward by pipes, canals, and tunnels. Appendices present: (1) field testing of irrigation fittings. (2) water saving fittings, and (2) industrial financing of water saving projects. (Lynch-Wisconsin)
W80-00471

RIVER BASIN PLANNING IN CANADA,
Department of the Environment, Ottawa (Ontario). Water Planning and Management Branch
For primary bibliographic entry see Field 6A.
W80-00472

U.S. INLAND WATER TRANSPORTATION,
Department of Transportation, Washington, DC.
J. L. Craig, and L. Y. Wald.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2371-2384.

Descriptors: *United States, *Inland waterways, *Transportation, *Rivers, *Canals, *Water management(Applied), *Navigable waters, Intracoastal waterways, Channel improvement, Governments, Local governments, Federal governments, State governments, Environmental effects, Administrative agencies, Institutions, Water resources development, Shipping, Navigation.

The inland waterways transportation system in the United States, considered 95% complete, was largely developed by the federal government, which builds, operates, maintains, and modernizes channels, locks, and dams. State and local governments, special authorities, and private interests have provided port and terminal facilities, land easements, and right of way, and private industry has contributed engineering innovations. The Federal Government spent about $4.6 billion through 1974 on construction, maintenance, and operation. Only limited further development of new waterways or river canals is anticipated due to rising costs, declining potential economic benefits, environmental considerations, and changing national priorities. The continental U.S. has 41,124 km of navigable inland and intracoastal channels, exclusive of the Great Lakes. The Mississippi River and Gulf Intracoastal Waterway systems account for 58% of the total mileage and 73% of prime channels with depths of 2.7-4.2 m. Of total U.S. intercity freight traffic, inland waterway transportation in 1974 was 9.5% of tonnage and 10.1% of ton-miles. Petroleum and coal account for 53% of the total waterborne tonnage of 1.7 billion tons/yr. Four federal agencies play important roles in inland waterways operation, the U.S. Army Corps, Interstate Commerce Commission, U.S. Coast Guard, and Maritime Administration. Environmental problems related to inland waterways include fuel consumption, disposal of dredged materials, and pollution by sewage and hazardous substances. (Lynch-Wisconsin)
W80-00473

THE INDUSTRIAL WATER SERVICE OF JAPAN,
Ministry of International Trade and Industry, Tokyo (Japan).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 4, p 2439-2450.

Descriptors: *Japan, *Industrial Water Service(Japan), *Industrial water, *Water supply development, Water management(Applied), Groundwater, Administrative agencies, Institutions, Water demand, Local governments, National governments, Water rates, Financing, Costs, Subsidies.

Without it's Industrial Water Service, Japan could not have achieved its current level of local development and industrial/economic growth; construction has been in progress for 20 years, funded in part by a subsidy system established in 1956. By April 1976 170 projects had been completed, with water supply capacity of 19 million cu m/day. Another 76 projects are under construction, having capacity of 10 million cu m/day. The system has provided new sources of water supply to replace unreliable groundwater supplies. In recent years the service has met more than half the increment in industrial water demand. A total of 829 billion yen have been spent on the system, 206 billion from subsidies. The remainder has come from government securities and loan corporation bonds and from private corporate bonds. Although original plans envisioned participation of private organizations in system construction and management, the majority of the projects were undertaken by local governments and are run as local public services. Of the 90 Industrial Water Services, 83% are run by prefectural governments. Rates are set according to the financial requirements of management. Of the 230 million cu m/day water demand predicted for 1985, 78 million cu m/day will be supplied by the service, an increase of 30 million cu m/day over 1970. Whereas construction has been concentrated in littoral industries, inland businesses will receive more attention. (Lynch-Wisconsin)
W80-00476

COASTAL ZONE MANAGEMENT IN THE UNITED STATES,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
R. R. Gardner.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 4, p 2483-2489.

Descriptors: *United States, *Coastal Zone Management Program, *Water management(Applied), *Coasts, *Comprehensive planning, *State governments, *Regulation, Federal governments, Ecology, Planning, Ecosystems, Urbanization, Industrialization, Land use, Permits, Zoning, Administrative agencies, Institutions, Legislation, Environmental effects, Water pollution control, Air pollution

The U.S. Coastal Zone Management Program was created in 1972 in response to intense urban and industrial development of coastal regions. Unlike other resource protection programs, it adopts a comprehensive approach regulating all coastal activities to solve such individual problems as water pollution and wetland destruction. Rather than focusing on wateror air, the program deals instead

with the nature and location of development itself. Jurisdiction includes the land area, coastal waters, bays, and estuaries. An effort is made to return land-use control from local authorities to state governments, restricting the federal role to promoting coastal management through financial assistance contingent on compliance with federal guidelines. A unique provision is that once a state coastal program has been approved, all subsequent federal actions must be consistent with that program. The state programs generally aim to balance development and preservation requirements. Three phases are involved: (1) preparation (data collection, identification of appropriate authorities, boundaries establishment, preparation of a program document, and federal approval); (2) implementation (enabling legislation, governmental reorganization, etc.); and (3) operation. Up to 80% federal funding is provided for all phases. As of 1976 Washington had an approved program in operation, and most of the other 33 states and territories were in the second or third year of preparation. (Lynch-Wisconsin)
W80-00478

BOUNDARY WATERS MANAGEMENT,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
R. L. Pentland, and B. L. Long.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol 1, part 4, p 2525-2538.

Descriptors: *Treaties, *International Joint Commission, *United States, *Canada, *International waters, *Water management(Applied), *Great Lakes, *St. Lawrence Basin, International cooperation, Boundary waters, Lakes, River basins, Institutions, Navigation, Water Pollution control, Political aspects, Water rights, Jurisdiction, Water levels, Boundary Waters Treaty of 1909, International law.

The successful boundary water agreements between the United States and Canada are based on two premises: (1) one country may not undertake water-related activities at the expense of the other, and (2) international water problems must be resolved cooperatively and in accordance with agreed principles, such as those embodies in the Boundary Waters Treaty of 1909. The International Joint Commission, established by the treaty, has achieved consensus in over 95% of issues submitted to it, and a provision for binding arbitration has never been used. A major strength of the IJC has been its direct access to technical assistance from departments and agencies of both governments, access which has been notably nonpolitical. A recent trend is toward more public operation of the IJC, with reduced confidentiality of reports and information. Some 3900 of the 8900 km of the U.S.-Canadian border lie along or across water bodies, including the Great Lakes-St. Lawrence Basin. The IJC is empowered to investigate and report upon matters of difference referred to it by either or both governments and to make nonbinding recommendations. IJC approval is required for any use, obstruction, or diversion of boundary waters in one country affecting the natural level or flow in the other. Procedures are described. The treaty guarantees free and open navigation on all boundary waters to both countries and on canals in one country but connecting boundary waters tolls must be the same for both countries. Use and control rights are specified, and pollution is regulated. (Lynch-Wisconsin)
W80-00480

IRRIGATION MANAGEMENT IN DEVELOPING COUNTRIES: A SUGGESTED ACTION PROGRAMME,
Overseas Development Inst., London (England).
For primary bibliographic entry see Field 3F.
W80-00481

POLLUTION CONTROL IN THE MINING INDUSTRY IN SOUTH AFRICA,
For primary bibliographic entry see Field 5G.
W80-00484

WATER USA: 1776-1976,
Colorado State Univ., Fort Collins. Dept. of Political Sciences.
H. P. Caulfield, G. D. Cobb, T. Schad, and H. A. Steele.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978. Pergamon Press. Vol 1, Part 4, p 2617-2639.

Descriptors: *United States, *History, *Water resources development, *Water management(applied), *Planning, *Legislation, Political aspects, Water conservation, Environmental effects, Water pollution control, Flood control, Navigation, Water utilization, Economic development, River basins, Watershed management, Water policy, Evluation, Groudwater, Surfacewaters, Industrial water, Recreation, Institutions, Administrative agencies.

The relationship between water management in the United States and national goql and objectives is analyzed from a historical perspective, 1776-1976. Contents: (1) Early growth of the nation. (2) Origins of a national water policy in the 19th and early 20th centuries, with a discussion of the beginning of the conservation movement. (3) The era of major water resource development, 1933-1945. (4) The environmental movement beginning in the Institutional arrangements for improved water management, including the Water Resources Planning Act of 1965, the Water Resources Council, federal agencies responsible for water resources management, and river basin organizations. (6) National water resources planning. (7) Role of water in future national development (population and economic growth, domestic use, mining and energy production, manufacturing, food and fiber production, recreation, navigation, water quality, water use). (8) Evaluation of the U.S. experience. A major deficiency has been a failure to adequately relate water quality questions to other aspects of water resources management, resulting in the current major investments to restore water quality. Protection of ecological systems was also neglected, and there was a failure to plan for, and to provide institutional arrangements, for integrated management of ground and surface waters, and for flood plain management. Accomplishments have included safe drinking water, major water development programs, intergovernmental cooperation, integrated and comprehensive management, and management of international waters. (Lynch-Wisconsin)
W80-00486

FEDERAL TAX INCENTIVES FOR PRIVATE ENVIRONMENTAL PLANNING,
Hill and Barlow, Boston, MA.
K. Browne.
Natural Resources Lawyer, Vol. 10, No. 4, p 753-759, 1978.

Descriptors: *Regressive taxes, *Land use, *Indirect benefit, *Tax incentives, *Easements, *Estate taxes, Taxes, Land appraisals, Evaluation, Economic justification, Open space preservation, Planning, Legal aspects, Land tenure, Public access, Economics, Competing uses, Assessments, Eminent domain.

Indirect subsidies through charitable tax deductions are not fully appreciated by private landowners and may not last long in their present form, because federal support for private open space protection through tax deductions are not likely to be continued indefinitely without conditioning such support on compliance with sound land use regulations. A hypothetical problem is given to illustrate use of federal tax incentives to preserve open space. The problem involves an island occupied by one family just off a heavily populated coastline, the value of which has heavily increased. Death taxes will consume most of the family liquid assets leaving the surviving widow and children land-poor and short of needed income. Three kinds of remedies are suggested, all of which may in many cases relieve the widow of part of the death tax burden and additionally help satisfy local objectives for open-space land use controls: (1) a conservation restriction or easement, which severs development rights inherent in the land; (2) a charitable remainder gift, in which the widow retains right to the property during her lifetime with possession passing onto a charity or subdivision after her death; (3) the bootstrap technique, which involves sale of a portion of the land in order to maintain the rest in open space for family use. (Harris-Wisconsin)
W80-00496

IMPLEMENTATION STRATEGIES FOR PUBLIC LAW 92-500, SECTION 208,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
S. D. Sidrane.
Discussions in Environmental Health Planning, October 1978. 114 p, 9 fig, 78 ref.

Descriptors: *Water quality control, *Water quality management(Applied), *Federal Water Pollution Control Act, *208 water quality planning, *Water resources planning, *Water pollution control, Models, Water quality, Institutions, Funding, Public participation, Social aspects, Political aspects, Administration, Local governments, Regions.

The author analyzes, describes and relates the current effectiveness of the Federal 208 Water Quality Planning Program. This program is not seen as achieving its desired objectives due to a lack of integration between water quality management programs and political agendas, and due to a lack of government ability to maintain an active public constituency concerned with continuing the program. Four institutional water quality management models are examined to test this hypothesis. The areawide model is found to enable planners to communicate closely with a constituency, but within a limited jurisdiction; the basinwide model considers water quality under one geographical unit, but frequently the authority is removed from its constituency; the regional-state management model has similar problems to the basinwide agency model, although it has more authority to carry out its management program; the congressional-federal agency model usually has the best access to information and has a strong source of authority, but is farthest removed from a potential supporting constituency at the local level. The author concludes that the 208 planning program can only succeed through full acceptance by local governments, creation of a continuing planning agency process to continue the program, redefining 208 priorities, and a review of individual management work plans and the need for further research. (Arnold-NC)
W80-00524

INTEGRATION OF RESIDUAL WASTE MANAGEMENT WITH WATER QUALITY MANAGEMENT,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
E. M. Dollard.
Discussions in Environmental Health Planning, January 1979. 204 p, 5 fig, 2 tab, 131 ref.

Descriptors: *Water quality, *Water quality management, *Water management(Administrative), *Water pollution, *Wastewater management, *Federal Water Pollution Control Act, *Residuals, *Residual waste management, Planning, Water reuse, Sewage treatment, Sludge, Wastewater treatment, Sewage effluents, New York, Massachusetts.

This study assumes the interrelationship of water quality management, defined as management of water for its suitability for certain purposes, and residual waste management, or management of those substances remaining after completion of various human processes such as agriculture and manufacturing. Water quality and residual wastes are seen as related concerns, and should not be dealt with by separate administrative organizations. As an example, as larger wastewater treatment plants are built, they will, while improving water quality, nevertheless generate more sludge. Reuse and land application are two suggested methods for using this increased sludge load. An

historical perspective reveals that while authority to control water pollution has shifted to the federal government, residuals management has remained largely a state perogative. A regional approach, using federal and state grant mechanisms, is proposed for integrating the control of water quality and residuals management under one administrative unit. Two regional planning areas, one in New York and one in Massachusetts, have adopted such an integrative strategy. A five step process for such program integration at the regional level includes identification of problems common to both management functions, collection of data relating one function to the other, inclusiong of the public and private industry in the planning process, design of programs which consider water quality-residual waste interrelationships, and implementation and evaluation of water quality-residual waste program. (Arnold-NC)
W80-00526

INTEGRATED PLANNING AND WATER QUALITY MANAGEMENT: THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 AND COASTAL ZONE MANAGEMENT,
Cornell Univ., Ithaca, NY. Program in Urban and Regional Studies.
W. K. Allayaud.
Discussions in Environmental Health Planning, January 1979. 217 p, 2 fig, 5 tab, 56 ref.

Descriptors: *Water quality, *Water quality management(Applied), *208 planning, *Coastal zone management, *Federal Water Pollution Control Act, *Environmental regulation, *New York, *Long Island(NY), *Water pollution control, Planning, Land use, Land use controls, Sewage disposal, Institutions, Governments, Potable water, Legislation.

This report relates water quality management planning issues to coastal zone management issues. The 208 planning process and coastal zone management must be integrated, which causes both legal and institutional problems. The author examines the problems of integrating the planning processes vis-a-vis five issues: integration of land and water planning; the role of local, state and federal government; coordination and integration of planning processes; sewage disposal in the coastal zone; and the 208 plan. The need for integration of land and water planning is clear but many limiting obstacles and conflicts exist. However, integration can be achieved to various degrees, with state government being the logical center to accomplish this. Recommendations include: states should play a lead role in integration of land and water planning, with supportive national policy and federal funds and assistance through national programs that encourage integration; states should assume a stronger role in policy decisions and plan implementation under both PL 92-500 and CZMA; integration of water quality planning processes is essential; decisions on ocean disposal of sewage should be postponed, allowing for continued planning to clarify the situation. A number of key recommendations are made concerning the 208 planning process and resulting 208 plans, including strong land use concerning the 208 planning process and resulting 208 plans, including strong land use control, 208 plans that can be integrated with coastal zone management plans, establishment of criteria for plan approval, and consideration of whether the plan can be implemented. Two case studies are presented to show the issues involved in integrating 208 planning with coastal zone management--New York State and Long Island, NY. (Cooper-NC)
W80-00527

INSTREAM FLOW STRATEGIES FOR WASHINGTON,
Enviro Control, Inc., Fort Collins, CO.
W. Nelson, G. Horak, and S. Wilsey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 046, Price codes: A05 in paper copy, A01 in microfiche. Fish and Wildlife Service, Biological Services Program FWS/OBS-78/46. May 1978. 107 p, 10 tab, 155 ref. 14-16-0008-2121.

Descriptors: *Water resources, *Washington, *Streamflow, *Fish and wildlife, *Aquatic habitat, *Water law, *Reservoirs, *Evaluation matrix, *Information matrix, *Reservoir storage, *Planning, Navigable waters, Engineering alternatives, Reservoir construction, Matrices, Stream channels, Water rights, Dams, Sediment release, Water permits.

This study identifies, describes and evaluates strategies and institutional methods for reserving instream flows for fish and wildlife in the State of Washington. Five strategies--appropriative water rights, legislative and administrative controls, water resource planning, water resource management, and engineering alternatives--are presented in an information matrix to help decision makers select strategies most applicable to any given situation. A general description of the strategy is presented, along with the most applicable situations for its use, a list of parties who can initiate the strategy and the parties who must implement it. An evaluation matrix is then presented which provides a subjective analysis of whether each of the five strategies has been used to advantage or disadvantage in Washington or whether it is not applicable in this state. Each strategy is described in detail in the narrative section of the report, including its application possibilities, the use of the strategy in the state, and an evaluation of its general utility General findings indicate that there are numerous ways in which appropriative water rights under state law may be used to preserve instream flows; existing administrative and legal controls allow for preservation policies to emerge; water resource planning under federal programs and water resource management options for instream flow maintenance are numerous and can be effective; and engineering alternatives have been used and can be effective for reserving instream flows. (Arnold-NC)
W80-00531

INSTREAM FLOW STRATEGIES FOR CALIFORNIA,
Enviro Control, Inc., Fort Collins, Co.
W. Nelson, G. Horak, and M. Lewis.
Fish and Wildlife Service Biological Services Program, FWS/OBS-78/36, May 1978. 96 p, 9 tab, 138 ref.

Descriptors: *Water resources, *California, *Streamflow, *Fish and wildlife, *Aquatic habitat, *Water law, *Reservoirs, *Evaluation matrix, *Information matrix, *Reservoir storage, *Planning, Navigable waters, Engineering alternatives, Federal Water Resource Council, Reservoir construction, Matrices, Stream channels, Dams, Sediment release, Water purity.

This study identifies, describes and evaluates strategies and institutional methods of reserving instream flows for fish and wildlife in California. Five strategies--appropriative water rights, legislative and administrative controls, water resource planning, water resource management, and engineering alternatives--are presented in an information matrix to help decision makers select strategies most applicable to any given situation. A general description of the strategy is presented, along with the most applicable situations for its use, a list of parties who can initiate the strategy and the parties who must implement it. An evaluation matrix is then presented; it provides a subjective analysis of whether each of the five strategies has been used to advantage or disadvantage in California, or whether it is not applicable to the state. Each strategy is described in detail in the narrative section of the report, including its application possibilities, the use of the strategy in the state, and an evaluation of its general utility. The major findings are that there is a lack of state appropriative water rights laws to preserve instream flow; existing legislative and administrative controls are being applied in the state and are effective tools; water resource planning under three federal programs has not been implemented in California but could be utilized to advantage; water resource management programs have had some success in the state, but some programs have no utility; and that existing engineering alternatives do allow for continuance of existing instream flows necessary for fish and wildlife habitat. (Arnold-NC)
W80-00532

WATER RESOURCES AND THE NATION'S WATER SUPPLY: ISSUES AND CONCERNS,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6B.
W80-00542

COLORADO RIVER BASIN WATER PROBLEMS: HOW TO REDUCE THEIR IMPACT,
Comptroller General of the United States, Washington, DC
Report No. CED-79-11, May 4, 1979. 137 p, 15 append.

Descriptors: *Colorado River Basin, *Water resources management, *Water supply, *Regional development, *Water policy, *Water resources, *Water utilization, *Water resources planning, River basin commissions, Water quantity, Irrigation water, Water demand, Water law, Social aspects, State governments.

This report analyzes major management problems with the Colorado River system, which drains 242,000 square miles in seven Western states. The primary concern is that unless the appropriate local, State and Federal agencies develop effective inter-cooperation, this seven state area will not be able to cope with a probable water shortage soon after the year 2000. Current water supply is insufficient to meet future demands and the current salinity control program may not be cost effective in achieving desired results. New methods of managing the Basin's water resources are needed. The average annual flow of the river dropped 18% between 1903 and 1977. Salinity levels have increased due to a rise in usage through diversion of upstream water. New methods for managing the basin's resources include more local-Federal agency conflict resolution and consideration of all water resources in the basin as a total system. The GAO recommends forming a politically sensitive Basin Task Force to delineate and propose solutions to the issues outlined in this study. Appendices include identification of selected legislation and compacts affecting operations of the Colorado River, availability and use of groundwater, salinity control projects, efforts to conserve and augment water supply, and Indian water rights claims. (Arnold-NC)
W80-00545

WAYS TO RESOLVE CRITICAL WATER RESOURCES ISSUES FACING THE NATION,
Comptroller General of the United States, Washington, DC.
Report No. CED-79-87. April 27, 1979. 44 p, 17 ref. 2 append.

Descriptors: *Water resources planning, *Cost/benefit analysis, *Water policy, *Water law, *Water resources development, Social aspects, Costs, Water supply, Water management, Water users, Conservation, Water consumption, Groundwater.

This report outlines critical water resource problems in the United States and how these problems may be resolved. Noting that the President's May 23, 1977 Environmental Message called for a vast overhaul of Federal Water Policy, this report examines water issues in light of that message. Steps such as combining the authorization and funding stages of a project to quicken project approval are recommended. Also proposed is the use of flexible authorization ceilings to allow for inflation and avoid delay in project approval and construction. Strengthening the role of either the Office of Management and Budget (OMB) or the Water Resources Council (WRC) could make project cost/benefit analyses more reliable. Serious groundwater problems can only be answered once overall policy questions relating to proper level of management are addressed. Urban areas face serious water shortages due to overuse of existing capacity and declining streamflows in some places; water conservation programs are advocated as the primary solution to this problem. The report recommends that Congress should reevaluate the 160

acre limitation on land eligible to receive water from Federal projects. Policy options for increasing State and local control and responsibility for water resources are discussed. Lack of a comprehensive national water policy and priorities and lack of reliable data for decision making would affect the potential success of these options. (Arnold-NC)
W80-00546

GUIDELINES FOR URBAN DEVELOPMENT IN LOUISIANA'S COASTAL WETLANDS,
New Orleans Univ., LA. Urban Studies Inst.
For primary bibliographic entry see Field 4C.
W80-00547

APPROPRIATIVE WATER RIGHTS AND EFFICIENT ALLOCATION OF RESOURCES,
New Mexico Univ., Albuquerque.
H. S. Burness, and J. P. Quirk.
American Economic Review, Vol. 69, No. 1, p 25-37. March 1979, 9 ref. 2 append, EX-76-G-03-1305.

Descriptors: *Water resources development, *Prior appropriation, *Appropriation, *Mathematical models, *Appropriative rights, *Water rights, *Water allocation, Water supply, Water utilization, Water transfer, Riparian rights, Relative rights, Appropriative doctrines, Diversion capacity, Water use, Economic efficiency, Surface water.

The authors propose a model for an efficient allocation of water rights among users under a variation of the appropriative doctrine commonly in practice in the Western United States. Because the present appropriative doctrine favors senior users, users on a 'first come-first served' basis, junior industrial users--important elements of a local economy--may not be able to be allocated their water resources efficiently, leading to suboptimal investment of capital and diversion capacity. Eight propositions, supported by mathematical explanations, are made to illustrate the inequities of the present appropriative system. These propositions indicate that senior water users are in a preferred position, that the addition of each user firm on a waterway renders the allocation system more inefficient if the marginal cost of adding diversion capacity increases, and that in the long run equal sharing of water rights by small users with similar profit functions leads to a more efficient distribution under the appropriative system. Senior users tend to establish an advantage over junior users by locating so as to best use streamflow for their needs, and thus junior users may be at a double disadvantage even though their needs may be legitimately equal to or greater than those of their seniors. Water rights transfer is an important legal mechanism for meeting this problem. (Arnold-NC)
W80-00548

SUMMARY: SOCIAL, ECONOMIC, AND INSTITUTIONAL ASPECTS OF WILDLIFE ENHANCEMENT IN IRRIGATED AGRICULTURE: A STUDY OF THE COLUMBIA BASIN IRRIGATION PROJECT,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 6G.
W80-00633

SOCIAL, ECONOMIC, AND INSTITUTIONAL ASPECTS OF WILDLIFE ENHANCEMENT IN IRRIGATED AGRICULTURE: A STUDY OF THE COLUMBIA BASIN IRRIGATION PROJECT,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 6G.
W80-00634

6F. Nonstructural Alternatives

THE UNITED STATES EXPERIENCE IN FLOOD PLAIN MANAGEMENT,
Department of Housing and Urban Development, Washington, DC.
N. Lally, G. R. Phippen, and F. H. Thomas.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press. Vol. 1, part 4, p 2071-2086.

Descriptors: *United States, *Flood plains, *Flood control, *Management, *Planning, *Policy, *Nonstructural alternatives, Flood forecasting, Reservoirs, Occupancy adjustments, Flood adjustments, Dams, Dikes, Flood protection, Channel improvement, Incentives, Federal government, Local governments, State governments, Civil engineering, Diversion structures, Water management(Applied).

In the United States, where annual flood damages amount to $2-3 billion, flood plain management initially relied upon high-capital-intensive flood control adjustments at the federal level, leaving low-capital-intensive occupancy adjustments to be applied at the state and local levels. But in the last decade a mix of the two strategies has been adopted in a unified federal state, and local approach. The Federal Flood Control Act of 1936 first made flood control a national policy. The two basic management strategies involve: (1) actions to minimize susceptibility of areas and individuals to flood damage and to minimize damage itself (occupancy adjustments), and (2) actions to modify flood behavior (flood adjustments). Occupancy adjustments include management of flood plain land use and structures, flood forecasting and warning systems, and flood disaster planning and assistance. The more extreme flood adjustment measures, usually costly and environmentally disruptive, include dams and reservoirs, dikes, levees, floodwalls, channel alterations, high flow diversions and spillways, land treatment to decrease runoff (usually in rural areas), an on-site storage of urban runoff waters. Successful flood plain management involves four basic principles: (1) flood plains must be considered in terms of total community, regional, and national planning and management; (2) flood lose reduction is related to economic efficiency, environmental quality, health, and safety; (3) management decisions can be partitioned between national and local levels; and (4) sound management incorporates goals, needs, strategies, accounting, and incentives. (Lynch-Wisconsin)
W80-00459

ON ROLE OF ADMINISTRATIVE, ECONOMIC AND TECHNOLOGICAL MEASURES IN PROTECTION OF SURFACE AND SUBTERRANEAN WATER AGAINST CONTAMINATION AND DEPLETION,
All-Union Scientific Research Inst. for Protection of Waters (USSR).
For primary bibliographic entry see Field 6E.
W80-00465

ON WATER REUSE PROMOTION MEASURES,
Ministry of International Trade and Industry, Tokyo (Japan).
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, part 4, p 2453-2462.

Descriptors: *Water reuse, *Japan, *Desalination, *Industrial wastes, *Wastewater treatment, *Municipal wastes, *Subsidence, Water purification, Recycling, Water shortage, Water supply development, Water sources, Industrial water, Municipal water, Reverse osmosis, Multi-flush method, Methodology, Sewage treatment, Denitrification, Biological treatment, Activated charcoal, Water Reuse Promotion Center(Japan).

To meet a predicted Japanese water shortage of four billion cu m/yr by 1985, water reuse programs are being developed as a substitute for conventional surface water and ground-water sources. Water supply is increasingly limited due to ground subsidence which restricts groundwater pumping and factors inhibiting further reservoir development. The national Water Reuse Promotion Center, established in 1973, is concentrating primarily on: (1) city drainwater reuse, (2) industrial water recycling, and (3) desalination of seawater. Although treated municipal water was used in industry as early as 1951, quality of the recycled water is acceptable for only a few specific uses. Further expansion requires advanced treatment. Current experimental projects involve: (1) a demonstration plant for sewage reuse using activated charcoal absorption, (2) a gravity activated charcoal facility, (3) biological denitrification, and (4) powdered activated charcoal. Industrial wastewater recycling has been largely limited to cooling and air-conditioning water; experiments to reuse wastewater from manufacturing and washing processes deal with: (1) petrochemical combinate wastewater, (2) pulp and paper factory wastewater. (3) iron and steel wastewater, and (4) dyeing and weaving plant wastewater. Desalination methods under development include multiflush and reverse osmosis. A prototype multiflush plant being planned will have a capacity of 100,000 cu m/day. (Lynch-Wisconsin)
W80-00477

COASTAL ZONE MANAGEMENT IN THE UNITED STATES,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
For primary bibliographic entry see Field 6E.
W80-00478

6G. Ecologic Impact Of Water Development

NOTE TO THE UNITED NATIONS WATER CONFERENCE ON PREPARATIONS FOR THE UNITED NATIONS CONFERENCE ON DESERTIFICATION.
For primary bibliographic entry see Field 2A.
W80-00422

WORLD WATER BALANCE AND WATER RESOURCES OF THE EARTH,
National Committee for the International Hydrological Programme (USSR).
For primary bibliographic entry see Field 2A.
W80-00466

FLORAL AND FAUNAL CHANGES IN LOWLAND HARDWOOD FORESTS IN MISSOURI RESULTING FROM CHANNELIZATION, DRAINAGE, AND IMPOUNDMENT,
Missouri Univ.-Columbia, Puxico. Gaylord Memorial Lab.
L. H. Frederickson.
Fish and Wildlife Service, Biological Services Program FWS/OBS-78/91, January 1979. 130 p, 7 fig, 20 tab, 3 append, 38 ref. 14-16-6008-1195.

Descriptors: *Forests, *Water resources development, *Channelization, *Drainage, *Impoundment, *Riparian habitat, *Mingo Swamp(MO), *Missouri River Basin, *Wildlife habitat, Water resource planning, Fish and wildlife, Aquatic habitats, Drainage effects, Plant communities, Hardwood forests, Wildlife management, Wildlife, Marsh management.

This study was designed to gather data on the effects of decreasing forest cover in the lower Mississippi Valley. The objectives were to identify the effects of channelization, impoundments, and drainage on plant and animal communities, and to develop reliable techniques to monitor and predict changes in these communities as a result of such actions. The Mingo Swamp, along a portion of the St. Francis River in Southeastern Missouri, was the study area. Photo interpretation provided overall information on the nature of tree cover with line transects gathered; data on species composition and density were gathered along line transects selected randomly along the river. Among the conclusions reached were that stream channelization reduced or changed riparian habitat, decreasing forest area by as much as 78% as compared to no more than 7% in unchannelized areas; sites inundated the longest had plants most tolerant to flooding; bird populations tended to avoid channel-

ized streams; and that channelization does reduce flooding and benefit agriculture. Recommendations made indicated that other developmental alternatives, such as construction of levees and government purchase of land to protect riparian habitat, are preferred over the adverse effects of channelization, and farmers should be made aware of the changes effected on forest composition from the drainage of their land. (Arnold-NC)
W80-00528

INSTREAM FLOW STRATEGIES FOR WASHINGTON,
Enviro Control, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 6E.
W80-00531

INSTREAM FLOW STRATEGIES FOR CALIFORNIA,
Enviro Control, Inc., Fort Collins, Co.
For primary bibliographic entry see Field 6E.
W80-00532

IMPACT ASSESSMENT OF WATER RESOURCE DEVELOPMENT ACTIVITIES: A DUAL MATRIX APPROACH,
Fish and Wildlife Service, Kearneyville, WV. Water Resources Analysis.
For primary bibliographic entry see Field 6B.
W80-00550

SUMMARY: SOCIAL, ECONOMIC, AND INSTITUTIONAL ASPECTS OF WILDLIFE ENHANCEMENT IN IRRIGATED AGRICULTURE: A STUDY OF THE COLUMBIA BASIN IRRIGATION PROJECT,
Washington State Water Research Center, Pullman.
B. F. Wolfley, S. C. Matulich, R. D. Davies, R. L. Shew, and G. H. Bagwell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-105265, Price codes: A04 in paper copy, A01 in microfiche. Report No. 30, September 1979. 68 p, 2 tab, 36 ref. OWRT-C-7165 (No. 6213) (7), 14-34-0001-6213.

Descriptors: *Wildlife conservation, *Irrigated agriculture, Columbia basin, Fish and wildlife, *Social impacts, Institutional aspects, Economic aspects.

Declining wildlife populations have raised numerous questions concerning the future of public/private fish and wildlife and agricultural benefits created by irrigation development projects. Interrelationships of wildlife and irrigated agriculture were analyzed in terms of social impacts, economic tradeoffs, and institutional ramifications. A secondary purpose of this study was to establish tradeoffs among resources committed to agriculture and/or wildlife production. The study was interdisciplinary in nature and involved analyses from social, economic, and political/institutional disciplines. The analytical framework was designed to provide evaluation of the socioeconomic interaction of recreationists and landowners involved in the production and use of wildlife in irrigated agriculture, and to suggest possible means whereby a satisfactory combination of wildlife and agricultural production may be achieved. The institutional ramifications of incorporating irrigation development with wildlife enhancement are presented, and alternatives to assure long-term fish and wildlife benefits are identified. (See also W80-00634)
W80-00633

SOCIAL, ECONOMIC, AND INSTITUTIONAL ASPECTS OF WILDLIFE ENHANCEMENT IN IRRIGATED AGRICULTURE: A STUDY OF THE COLUMBIA BASIN IRRIGATION PROJECT,
Washington State Water Research Center, Pullman.
B. F. Wolfley, S. C. Matulich, R. D. Davies, R. L. Shew, and G. H. Bagwell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104532, Price codes: A16 in paper copy, A01 in microfiche. Report No 31, September 1979. 370 p, 2 fig, 66 tab, 4 append. OWRT C-7165(6213)(6), 14-34-0001-6213.

Descriptors: *Wildlife conservation, *Irrigated agriculture, Columbia basin, Fish and wildlife, Social impacts, Institutional aspects, Economic aspects.

Declining wildlife populations have raised numerous questions concerning the future of public/private fish and wildlife and agricultural benefits created by irrigation development projects. Interrelationships of wildlife and irrigated agriculture were analyzed in terms of social impacts, economic trade-offs, and institutional ramifications. A secondary purpose of this study was to establish tradeoffs among resources committed to agriculture and/or wildlife production. The study was interdisciplinary in nature and involved analyses from social, economic, and political/institutional disciplines. The analytical framework was designed to provide evaluation of the socioeconomic interaction of recreationists and landowners involved in the production and use of wildlife in irrigated agriculture, and to suggest possible means whereby a satisfactory combination of wildlife and agricultural production may be achieved. The institutional ramifications of incorporating irrigation development with wildlife enhancement are presented, and alternatives to assure long-term fish and wildlife benefits are identified. (See also W80-00633)
W80-00634

THE IMPORTANCE OF TRIBUTARY STREAMS TO THE REPRODUCTION OF CATOSTOMIOS AND SAUGER,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
K. D. Curry, and A. Spacie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104896, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 126, August 1979. 82 p, 14 fig, 34 tab, 67 ref, 1 append. OWRT A-052-IND(1).

Descriptors: *Saugers, *Suckers, *Spawning, *Tributaries, Catostomids, Stizostedion, Canadense, Fish reproduction, Streams, Wabash River, Deer Creek, Wildcat Creek.

Suckers (Catostomidae) and sauger (Stizostedion canadense) are important members of the fish community in the Wabash River. It has been hypothesized that river populations of suckers and sauger may be sustained by recruitment of young fish from tributaries. This study examined the importance of a Wabash River tributary to catostomid and sauger reproduction by determining the seasonal presence of adults and larvae within the system. Electrofishing, hoopnet, and blocknet catches on Deer Creek, Carroll County, Indiana, revealed a differential use of the tributary for spawning by species and by age-size groups. White suckers (Catostomus commersoni) were the dominant sucker in the headwaters during spring, while redhorse (Moxostoma) were most abundant in main stem Deer Creek. Shorthead redhorse (M. macrolepidotum) adults were only present in Deer Creek during spawning and did not enter its upper reaches. Spawning groups of golden redhorse (M. erythrurum) and black redhorse (M. duquesnei) were older and larger near the mouth of Deer Creek than spawning groups 12.8 km upstream in Bachelor Run. Adult sauger were collected only rarely in lower Deer and Wildcat Creeks. Their abundance in the tributaries did not increase during spring spawning although mature males and females were frequently captured in the Wabash River. Three adults tracked by radio tags remained in the main river during April.
W80-00637

DEVELOPMENT OF WATER RESOURCES AND ITS INFLUENCE ON THE ECOLOGY OF SAUDI ARABIA,
King Abdulaziz Univ., Jeddah (Saudi Arabia).
H. H. Hajrah.
Advances in Desert and Arid Land Technology and Development, v. 1, Adli Bishay and Wm. G. McGinnies, eds. Harwood Academic Publishers, 1979, p 211-218, 4 tab.

Descriptors: *Saudi Arabia, *Water resources development, *Water shortage, *Comparative productivity, *Alternative water use, *Water allocation(Policy), Arid lands, History, Water utilization, Competing uses, Irrigation engineering, Dams, Reservoirs, Conveyance structures, Desalination.

An analysis of the ecological features of Saudi Arabia's western province including the southwestern and western highlands and seashore, and eastern province including the central Najd Plateau and the eastern seashore on the gulf. Indications are that this largely arid country has scarce water resources of poor quality, no running rivers, and rather restricted amounts of groundwater with low recharge rates to the aquifers by rain. An historical review of cultivated lands and their water systems is presented which shows that a continuous increase in consumption of water for household and drinking purposes has resulted in a decrease of available water for agriculture and a subsequent decrease in productivity of land and farms. Recently, however, dams and reservoirs have been constructed in the southern province and networks of channels established for irrigation. These developments, along with the desalination of Red Sea and Gulf waters and controlled agricultural techniques are advocated here for future development. (Tickes-Arizona)
W80-00640

7. RESOURCES DATA

7A. Network Design

EVALUATION OF ECONOMIC BENEFITS OF HYDROLOGICAL SERVICES,
For primary bibliographic entry see Field 6B.
W80-00414

CURRENT METHODOLOGIES FOR THE COLLECTION AND DISSEMINATION OF WATER RESOURCES DATA IN THE UNITED STATES,
Geological Survey, Reston, VA.
G. H. Davis.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol. 1, part 4, p 2387-2411.

Descriptors: *Water resources, *Data storage and retrieval, *Data collections, *Information exchange, *Networks, *United States, Information retrieval, Methodology, Meteorological data, Hydrologic data, Data management, Decision making, Planning, Water policy, Research and development, Water management(Applied), Financing, STORET, WATSTORE, Federal government.

U.S. experience in water resources data management shows that: (1) multipurpose hydrologic data acquisition, coordination, compilation, and dissemination are best handled by a fact-finding agency independent of water management agencies; (2) use of hydrologic data in decision-making is a direct measure of the effectiveness of communication between data collector and user; (3) a coordinated system with a broad institutional base should be a first priority; (4) planners, managers, and policymakers must consider the interrelationship of data base and water policy and the influence of methodology on data base adequacy; (5) hydrological and environmental data systems should be coordinated for input into research. Contents of this paper: (1) goals, history, criteria, and gaps of water management and data collection in the U.S.; (2) coordination of water data acquisition; (3) standardization of collection methods; (4) network design; (5) technology of data acquisition regarding precipitation and evaporation, streamflow and stage, water storage, groundwater, stream quality, and sediment transport; (6) data handling, storage, and retrieval; (7) publications; (8) recent advances; and (9) institutional arrangements, funding, and plans. Specific storage systems discussed include meteorological data, the Geological Survey's WATSTORE, and

EPA's STORET. Bureau of the Budget Circular A-67 (1967) assigned responsibility for a national water data network to the Department of the Interior, and in 1966 a catalog of water data was established. (Lynch-Wisconsin)
W80-00474

WATER-RESOURCES INVESTIGATIONS IN NEVADA, 1978.
Geological Survey, Carson City, NV. Water Resources Div.
Geological Survey Water-Resources Investigations in Nevada Folder, 1979. 1 sheet.

Descriptors: *Water resources, *Investigations, *Inter-agency cooperation, *Nevada, Surveys, Planning, Hydrologic data, Basic data collections, Precipitation(Atmospheric), Streamflow, Groundwater, Water quality, On-site investigations, Dissolved solids, Bibliographies, Networks, Maps, *Cooperative water-studies program.

Water-resources studies and investigations in Nevada in which the U.S. Geological Survey participates in cooperation with other agencies are summarized. A bibliography of selected material concerning these investigations is included. The investigations include collections of basic information through a hydrologic-data network, areal hydrologic or interpretative studies, and research projects. The hydrologic-data network consists of primary, secondary, and water management streamflow stations; ground-water observation wells; and water-quality observation sites. Small State maps show average annual precipitation, average annual runoff, flood-prone areas completed in Nevada, principal sources of ground water, discharge of the principal rivers, and the dissolved solids in ground waters. A map, scale 50 miles to the inch, shows by symbols, numbers, and colored outline the hydrologic-data network and investigations in Nevada as of January 1978. (Woodard-USGS)
W80-00776

7B. Data Acquisition

ASSESSMENT OF WATER RESOURCES: NETWORKS, SURVEYS, SERVICES, AND RELATED FACILITIES: PRESENT STATUS AND REQUIREMENTS BY 2000.
World Meteorological Organization, Geneva (Switzerland).
For primary bibliographic entry see Field 6A.
W80-00426

CURRENT METHODOLOGIES FOR THE COLLECTION AND DISSEMINATION OF WATER RESOURCES DATA IN THE UNITED STATES,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 7A.
W80-00474

REMOTE SENSING FOR WATER RESOURCES MANAGEMENT.
Geological Survey, Washington, DC.
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press; Vol. 1, part 4, p 2413-2429.

Descriptors: *Remote sensing, *Water management(Applied), *Satellites(Artificial), *Planning, *Aerial photography, *Water resources, *Multispectral scanners, Aircraft, Data collections, Information retrieval, Data storage and retrieval, Meteorological data, Land use, Thermal scanners, United States, Monitoring, Flood control, Water pollution control, Sensors, Erosion, Sedimentation, Turbidity, Water distribution(Applied), Mapping, Inventories, Costs, Landsat.

Remote sensing is useful for water management, complementing ground data and providing information otherwise unobtainable. Limitation include unfamiliar technology, high cost, and delays in processing and delivering information to users. This paper describes remote sensing systems, applications to water resources management, and factors affecting investments in remote sensing (costs, field calibration data, trade-offs, training, and education). Sensors include: (1) color and color-infrared photographic equipment, (2) radiometers, (3) thermal scanners, (4) multispectral scanners (MSS), and (5) active or passive microwave systems. Data can be collected in either analog (image) or digital form. Collection vehicles comprise aircraft (airplanes, helicopters, balloons), and compact, sophisticated satellites. The Landsat MSS has been the sensor of primary interest to most investigators; data are distributed mainly through the EROS Data Center. Water resources applications: weather forecasting, climatic changes, snow and ice dynamics, water circulation, sediment and pollution plumes, and movement, coastal processes, heated effluents, groundwater presence and discharges, soil moisture, geomorphology, beach and other water erosion, evapotranspiration, flood boundaries, drainage basin variables, streamflow, water distribution, lake condition, karst sinks, energy and water balances, gauging site distribution, lake condition, karst sinks, energy and water balances, gauging site selection, land-use planning, model development, and dam or levee seepage. Data Collection System (DOS) refers to real-time data relay via satellite. (Lynch-Wisconsin)
W80-00475

A DMSP NEAR IR SENSOR FOR CLOUD/SNOW DISCRIMINATION,
Westinghouse Electric Corp., Baltimore, MD.
A. W. Kimball, Jr.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 43-47, May 1979. 4 fig, 4 ref.

Descriptors: *Remote sensing, *Snow, *Infrared radiation, Satellites(Artificial), Measurement, Instrumentation, Clouds, Microwaves, Radiometric characteristics.

This presentation described an instrument built to fly on a Defense Meteorological Satellite Program (DMSP) satellite. Sensing reflected sunlight in the 1.5 micrometer region, it is designed to operate in conjunction with the visible channel of the primary sensor to demonstrate feasibility of automatic recognition of clouds over snow fields. The theoretical basis for the instrument was discussed briefly, and salient radiometric characteristics of the instrument were described. Briefly, a 48-element line array of intrinsic Ge detector elements lies in the image plane of a 40.2 degree wide angle lens designed to provide constant angular field of view per array element (14.6 mrad along track, 9.61 mrad along array on 14.6 centers along array), as well as an element illumination loss from center to end of only 12%. The instrument field of view will extend from subtrack perpendicular to the track and toward the sun, covering about 650 km on the earth's surface. To compensate for the variation in scene illumination from near subsolar to the terminator region (and to permit gain variation for enhancement of specific types of low radiance scenery), 16 gain states, spaced at 2.4 dB, are available and may be commanded from the primary sensor memory at specified programmed times along the orbital track. (See also W80-00566) (Humphreys-ISWS)
W80-00570

THE UNITED STATES ENVIRONMENTAL SATELLITE DATA ARCHIVES,
National Climatic Center, Asheville, NC.
E. R. Hoppe.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 49-56, May 1979. 5 ref, 1 append.

Descriptors: *Remote sensing, *Data collections, *Satellites(Artificial), Maps, Data storage and retrieval, Infrared radiation, Reviews, Meteorological data, Hydrologic aspects, Ice, Coasts, Information retrieval, Photography, Films, Data archives, TIROS, LANDSAT, SKYLAB, SEASAT.

The U.S. archives of environmental satellite data represent a unique source of information for various investigations within many scientific disciplines. While primarily intended for meteorological purposes, many of the sensors orbited on the more recent spacecraft also provide data of great value to hydrology and the marine sciences. The data held within the archives consist of imagery in both photographic and digital form, and, while the archives in their present form were initiated only in late 1974, photographic images from the earliest meteorological satellites of the 1960's through the latest geostationary spacecraft are included in the files. The files have been indexed and arranged to facilitate retrieval of data to answer requests. The arrangement has been based on experience gained in the past several years from the type and extent of requests serviced. Most requests have been concerned and primarily identified with a geographical area, a specific date or period, a certain sensor or spectrum, a specific phenomenon of interest, and a specified data resolution--in that order. Thus, the data are first separated by individual satellites with their unique areal coverage, further broken down by date and sensor type, and finally, by resolution or scale. Specific data formats, such as magnetic tape and 35-mm, 70-mm, 25- by 25-cm film, are also maintained in individual files. (See also W80-00566) (Humphreys-ISWS)
W80-00571

SATELLITE-DERIVED RIVER BASIN SNOW-COVER PERCENTAGES: A NEW DATA BASE FOR HYDROLOGISTS,
National Environmental Satellite Service. Washington, DC.
S. R. Schneider.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 57-60, May 1979. 1 fig, 1 tab, 3 ref.

Descriptors: *Snow cover, *Maps, *Remote sensing, *Snow surveys, Satellites(Artificial), Areal, Analytical techniques, Methodology, Hydrology, Data processing, Data collections, Watersheds(Basins), Snowpacks.

Hydrologists at NOAA's National Environmental Satellite Service (NESS) have been producing satellite-derived areal snow cover maps for selected river basins since 1973. Four basins were originally targeted for study, involving a variety of topographic, spatial, and climatological conditions. Heightened user interest, combined with an increase in manpower and equipment resources, has allowed NESS to expand the snow mapping program. During the 1977-1978 snow season, operational coverage was provided for 30 basins in the United States and Canada. Basin snow maps are made on an average of once a week beginning November 1st and terminating when the snowpack appears almost totally depleted on the imagery. The analyses can only be made when the basin is free of obscuring clouds. Accordingly, basins in the Southwestern United States and California's Sierra Nevada are mapped more often than those in the less cloud-free Pacific Northwest. The snow cover data are generally provided to users within 30 hours of a satellite overpass so they can be incorporated into watershed runoff forecast models. (See also W76-0208 and W80-00566) (Humphreys-ISWS)
W80-00572

LANDSAT-DERIVED SNOW COVER AS A FORECAST TOOL IN THE RIO GRANDE BASIN IN COLORADO,
Soil Conservation Service, Denver, CO.
For primary bibliographic entry see Field 2C.
W80-00573

NASA MAPPING PROJECTS (SUMMARY),
National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD.
For primary bibliographic entry see Field 7C.
W80-00578

WATER USE INFORMATION FOR PIMA COUNTY, ARIZONA,

Army Corps of Engineers, Los Angeles, CA.
M. F. Thuss.
Pima Association of Governments 208 Project, Element 6, Task 6320, Existing Water Use Overview, March 1978. 116 p, 9 fig, 29 tab, 20 ref.

Descriptors: *Water utilization, *Hydrologic data, *Competing uses, *Water allocation(Policy), *Water supply, Irrigation water, Industrial water, Municipal water, Recreation, Water demand, Water distribution(Applied), Water policy, Water management(Applied), Recharge, Hydrologic budget, Drainage districts, Pima County, Arizona.

Based upon already published information generated by many experts, current water use trends for agricultural, industrial, municipal, and recreational consumption are developed here for specified locations of Pima County, Arizona, including the Ajo area, the Avra and Altar Valleys, the Upper and Lower Santa Cruz, and the Upper and Lower San Pedro areas. The questions of where water is stored, how much water is available to be tapped as a supply, and how much water is replenished each year are addressed in an attempt to establish the water consumption portion of the present time water budget calculation. The water consumption rates for specified areas developed in this analysis are then applied to the PAG-208 drainage basin concepts to provide an accurate estimate of overall future water consumption. (Tickes-Arizona)
W80-00645

7C. Evaluation, Processing and Publication

CURRENT METHODOLOGIES FOR THE COLLECTION AND DISSEMINATION OF WATER RESOURCES DATA IN THE UNITED STATES,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 7A.
W80-00474

DATA SOURCES AND SEA ICE PRODUCTS OF FLEET WEATHER FACILITY/JOINT ICE CENTER, SUITLAND,
Fleet Weather Facility, Suitland, MD.
For primary bibliographic entry see Field 2C.
W80-00568

MAPPING AND ARCHIVING OF CANADIAN SEA ICE DATA,
Atmospheric Environment Service, Downsview (Ontario).
W. E. Markham.
In: Glaciological Data; Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 37-39, May 1979. 8 ref.

Descriptors: *Mapping, *Canada, *Sea ice, *Data collections, Maps, Ice, Ice breakup, Spatial distribution, Areal, Basic data collections, Publications, Ice thickness.

This paper briefly described Canada's ice program. Since 1958, the Atmospheric Environment Service (AES) has conducted ice reconnaissance in most Arctic, subarctic and Eastern Seaboard areas. The products of the AES ice service which are archived include: (1) Thousands of original ice observers' charts at a scale of 1:2,000,000 up to 1977, and recently, 1:1,000,000. (2) Composite ice charts at a scale of 1:4,000,000. (3) Historical ice charts at a scale of 1:6,000,000. (4) Bound copies of Ice Summary and Analysis. (5) An analysis--Ice Thickness Climatology was prepared in 1974. (6) Freezeup and breakup data collected at many Canadian weather stations. Existing Canadian atlases of sea ice are: (1) Ice Atlas of Arctic Canada; (2) Canadian Arctic Ice Atlas; (3) Ice Atlas--Eastern Canadian Seaboard; and (4) Ice Atlas of Canadian Arctic. (See also W80-00566) (Humphreys-ISWS)
W80-00569

ARCHIVING AND MAPPING OF CANADIAN SNOW COVER DATA,
Atmospheric Environment Service, Downsview (Ontario).
For primary bibliographic entry see Field 2C.
W80-00574

ACCURACY OF SNOW AND ICE MONITORING,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2C.
W80-00575

AN ARCTIC SEA ICE DATA SET, 1901-1956,
University of East Anglia, Norwich (England). Climate Research Unit.
For primary bibliographic entry see Field 2C.
W80-00576

INADEQUACIES IN ARCHIVED SEA ICE DATA,
Sea Ice Consultants, Camp Springs, MD.
For primary bibliographic entry see Field 2C.
W80-00577

NASA MAPPING PROJECTS (SUMMARY),
National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD
H. J. Zwally.
In: Glaciological Data: Workshop on Snow Cover and Sea Ice Data; Workshop held in Boulder, Colorado, November 2-3, 1978. p 109-111, May 1979. 1 fig, 2 tab, 2 ref.

Descriptors: *Mapping, *Data storage and retrieval, *Satellites(Artificial), *Data collections, Climatic data, Snow cover, Soil moisture, Vegetation, Precipitation(Atmospheric), Albedo, Ozone, Sea ice, Water temperature, Oceans, Ocean currents, Clouds, Radiation, Solar radiation, Nimbus, Seasat, Landsat, Tiros-N.

It is important to realize the differences among research and development satellites (e.g., Nimbus 1-7 and Seasat-1), quasi-operational satellites (Landsat-1-D), and fully operational satellites (TIROS-N, etc.). Also, there are various levels of data. Some satellite data sources and classification of data set levels were tabulated. Generally, most NASA satellite data are archived at Level I (physical quantities) and are available from National Space Sciences Data Center, Goddard Space Flight Center, Greenbelt, Maryland. However, the archived data vary greatly in quality, accuracy, and documentation. (See also W80-00566) (Humphreys-ISWS)
W80-00578

WATER WITHDRAWALS IN ILLINOIS, 1978,
Illinois State Water Survey, Urbana.
J. R. Kirk, J. Jarboe, E. W. Sanderson, R. T. Sasman, and R. A. Sinclair.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-105992, Price codes: A03 in paper copy, A01 in microfiche. ISWS Circular 140, 1979. 35 p, 4 fig, 7 tab, 39 ref, 1 append.

Descriptors: *Water utilization, *Illinois, *Census, *Data collections, Water supply, Groundwater, Surface waters, Rural areas, Basic data collections, Electric power industry, Industrial water, Municipal water, Cooling water, Irrigation water, Stock water, Wildlife.

This report, part of a continuing cooperative program with the U.S. Geological Survey, summarized the results of the 1978 Illinois Water Use Inventory. The water use data were presented for the following categories: Public Water Supply (1770.9 mgd), Self-Supplied Industry (44,331.0 mgd), Rural Water Use (220.0 mgd), and Fish and Wildlife Management Areas (44.2 mgd). The data were then further categorized by county, districts, hydrologic units, and Standard Metropolitan Statistical Areas. Illinois water withdrawals during 1978 were 46,366.1 mgd, of which groundwater provided 945.7 mgd and surface water sources supplied 45,420.4 mgd. The largest user of water in Illinois is electric power generation, 92% of the total withdrawals. Excluding electric power withdrawals, 1978 groundwater use was 939.5 mgd, and surface water use was 2915.0 mgd. (Humphreys-ISWS)
W80-00722

CONTAMINATION POTENTIAL IN THE SILURIAN DOLOMITE AQUIFER, EASTERN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-00757

DRAINAGE AREAS OF THE TWELVEPOLE CREEK BASIN, WEST VIRGINIA, BIG SANDY RIVER BASIN, WEST VIRGINIA, TUG FORK BASIN, VIRGINIA, KENTUCKY, WEST VIRGINIA,
Geological Survey, Charleston, WV. Water Resources Div.
M. W. Wilson.
Geological Survey open-file report 79-746, 1979. 50 p, 1 fig, 3 tab.

Descriptors: *Drainage area, *Streams, *Tributaries, *Sites, *Watersheds(Divides), Maps, West Virginia, Virginia, Kentucky, Distance, River miles, *Twelvepole Creek basin, *Big Sandy River basin, *Tug Fork basin.

Drainage areas were determined for 61 basins in the Twelvepole Creek basin, West Virginia; 11 basins of the Big Sandy River Basin, West Virginia; and 210 basins in the Tug Fork basin of Virginia, Kentucky, and West Virginia. Most basins with areas greater than 5 square miles were included. Drainage areas were measured with electronic digitizing equipment, and supplementary measurements were made with a hand planimeter. Stream mileages were determined by measuring, with a graduated plastic strip, distances from the mouth of each stream to the measuring point on that stream. Mileages were reported to the nearest one-hundredth of a mile in all cases. The latitude and longitude of each measuring point was determined with electronic digitizing equipment and is reported to the nearest second. The information is listed in tabular form in downstream order. Measuring points for the basins are located in the tables by intersecting tributaries, by counties, by map quadrangles, or by latitude and longitude. (Woodard-USGS)
W80-00765

WATER-RESOURCES INVESTIGATIONS IN NEVADA, 1978.
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-00776

WATER RESOURCES DATA FOR WISCONSIN, WATER YEAR 1978.
Geological Survey, Madison, WI. Water Resources Div.
Geological Survey Water-Data Report WI-78-1, April 1979. 488 p, 13 fig.

Descriptors: *Wisconsin, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for the 1978 water year for Wisconsin include records of streamflow at gaging stations, partial-record stations, and miscellaneous sites; records of reservoir storage, records of chemical, physical, and biological characteristics of surface water, ground water, and precipitation, and records of water levels in observation wells. Records for a few gaging stations in bordering States also included. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Wisconsin.

W80-00777

WATER RESOURCES DATA FOR SOUTH CAROLINA, WATER YEAR 1978.
Geological Survey, Columbia, SC. Water Resources Div.
Geological Survey Water-Data Report SC-78-1, March 1979. 248 p, 5 fig.

Descriptors: *South Carolina, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for South Carolina consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 57 gaging stations, stage-only records for 1 gaging station, stage and contents for 11 lakes and reservoirs, water quality for 25 gaging stations and 5 ungaged stations, and water levels for 23 observation wells. Also included are 46 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in South Carolina. (Woodard-USGS)
W80-00778

WATER RESOURCES DATA FOR HAWAII AND OTHER PACIFIC AREAS, WATER YEAR 1978--VOLUME 1. HAWAII.
Geological Survey, Honolulu, HI. Water Resources Div.
Geological Survey Water-Data Report HI-78-1, June 1979. 292 p, 14 fig.

Descriptors: *Hawaii, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Volume 1 of water resources data for the 1978 water year for Hawaii consists of records of stage, discharge, and water quality of streams; and water levels and water quality in wells and springs. This report contains discharge records for 114 gaging stations; water quality for 11 gaging stations, 98 partial-record flow stations, and 182 wells; and water levels for 25 observation wells. Also included are 106 crest-stage partial-record stations and 18 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, Federal, and other agencies in Hawaii. (Woodard-USGS)
W80-00779

WATER RESOURCES DATA FOR HAWAII AND OTHER PACIFIC AREAS, WATER YEAR 1978--VOLUME 2. TRUST TERRITORY OF THE PACIFIC ISLANDS, GUAM, AMERICAN SAMOA, AND NORTHERN MARIANA ISLANDS,
Geological Survey, Honolulu, HI. Water Resources Div.
Geological Survey Water-Data Report HI-78-2, June 1979. 108 p, 16 fig, 1 tab.

Descriptors: *Islands, *Pacific Ocean, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Mariana Islands, *Caroline Islands, *Samoa Islands.

Volume 2 of water resources data for the 1978 water year for other Pacific areas (not including Hawaii) consists of records of stage, discharge, and water quality of streams; stage of a reservoir; and water levels in wells and springs. This report contains discharge records for 44 gaging stations, stage only record for 1 gaging station, water quality for 1 gaging station and 5 partial-record stations, water temperature for 35 gaging stations, and water levels for 6 observation wells. Also included are 37 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating governments and Federal agencies in other Pacific areas. (Woodard-USGS)
W80-00780

8. ENGINEERING WORKS

8A. Structures

WORLD EMPLOYMENT PROGRAMME: APPROPRIATE CONSTRUCTION TECHNOLOGY FOR WATER CONTROL AND IRRIGATION WORKS IN DEVELOPING COUNTRIES,
For primary bibliographic entry see Field 6A.
W80-00419

TILLAMOOK BAY ENTRANCE REFRACTION STUDY, TILLAMOOK, OREGON,
Army Engineer Waterway Experiment Station, Vicksburg, MS. Hydraulics Lab.
L. Z. Hales.
Miscellaneous Paper H-77-8, August 1977. 4 fig, 2 tab.

Descriptors: *Waves(Water), *Refraction(Water waves), *Jetties, *Graphical analysis, *Model studies, *Wave theory, *Ocean waves, *Breakwaters, Oregon, Bays, Estuaries, Water circulation, Navigation, Shoals, Shallow water, Mathematical studies, Curves, Statistics, Flow, Currents(Water), Regression analysis, Tides, Tidal effects, Gravity waves.

On May 31-June 10, 1977, U. S. Army Corps of Engineers conducted a series of water refraction analyses for the offshore bar and entrance channel to Tillamook Bay, Oregon, to ascertain effects of extending a south jetty on regional wave characteristics. No specific conclusions were drawn but data were used to assess navigational hazards at the entrance between existing north jetty and proposed south jetty extension. Tillamook Bay is a tidal estuary six mi long and three mi wide with channel depth of 12-18 ft. Five rivers with total drainage of 574 sq mi flow into the bay. An existing north jetty extends 5700 ft and south jetty 4000 ft; a south jetty extension of 1550 ft was proposed to make it 150 ft short of the north jetty. The paper describes surface gravity wave transformations in shoaling water and consequent tidal wave effects. Wave sampling records indicate that conoidal wave shapes can be predicted with wavelength, wave height, and water depth determining wave profile. However, elliptic function complexity and solitary waves limit the conoidal wave theory. A three dimensional wave basin was created to simulate a tidal inlet and examine surface gravity waves. Under ebb flow conditions an area oceanward of the inlet entrance experiences greatest alteration to wave characteristics. (Danovich-Wisconsin)
W80-00501

8B. Hydraulics

DIVIDING-FLOW MANIFOLDS WITH SQUARE-EDGED LATERALS,
Water and Air Research, Inc., Gainesville, FL.
H. E. Hudson, Jr. , R. B. Uhler, and R. W. Bailey.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE4, Proceedings Paper 14764, p 745-755, August 1979. 4 fig, 2 tab, 18 ref, 3 append.

Descriptors: *Flow resistance, *Flow separation, *Pipe flow, *Hydraulics, Pipes, Flow, Closed conduit flow, Head loss, Pressure, Junctions, Model studies, Mathematical models, Manifolds, Entrances(Fluid flow), Dividing flow.

A method of analysis for dividing-flow junction losses based on correlation of numerous data sets was presented. Illustrative examples were given to describe the use of the analytical procedure to evaluate dividing manifold problems. The entry loss coefficients for laterals discharging from a dividing-flow manifold were found to bear lineal relationships to the squares of the ratios of manifold-to-lateral velocities. The entry loss coefficients for short laterals were larger than those for long laterals. Since the entry loss characteristic dictates dividing-flow distributions, the preferred design technique will compel equal flow distribution by maintaining the same manifold-to-lateral velocity ratio at every junction point. (Sims-ISWS)
W80-00582

DYE-VECTOR FLOW VISUALIZATION--COOLING WATER MODEL,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
V. W. Harms, and R. L. Wiegel.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW3, Proceedings Paper 14767, p 293-312, August 1979. 11 fig, 2 tab, 19 ref, 2 append.

Descriptors: *Cooling water, *Model studies, *Hydraulic models, Dye releases, Dyes, Photography, Currents(Water), Flow, Turbulent flow, Circulation, Water circulation, Velocity, Buoyancy, Mixing, Intakes, Discharge(Water), Hydraulics, Powerplants, Heated water, Water pollution, Dye-vector techniques, Flow visualization.

An extensive hydraulic scale model (densimetric Froude law) of the intake and discharge flows of the cooling water system of an ocean coast power plant with coastal currents made use of flow visualization techniques to obtain details of patterns near the discharge and intake. This was important to develop insights to the characteristics of the mixing and induced bottom flows. One technique was to drop dye crystals to the bottom and to photograph (in color) the growth of the dye vectors. This was so useful that a thorough quantitative study was made of the growth rate of these vectors, U sub d, relating the growth rate to the friction velocity, U sub *. The results were interpreted using boundary layer theory and numerical and physical model studies of low Reynolds number flow around objects. For a range of values of U sub * of practical importance in hydraulic model studies over hydraulic smooth bottoms, a linear relationship between U sub * and U sub d was established. (Sims-ISWS)
W80-00586

PERFORMANCE ANALYSIS OF TETHERED FLOAT BREAKWATER,
Scripps Institution of Oceanography, La Jolla, CA.
R. J. Seymour, and D. M. Hanes.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW3, Proceedings Paper 14755, p 265-280, August 1979. 9 fig, 4 tab, 3 ref, 2 append.

Descriptors: *Breakwaters, *Waves(Water), *Coastal engineering, Model studies, Mathematical models, Hydraulic models, Laboratory tests, On-site investigations, Harbors, Marinas, Ocean waves, Coasts, Energy, Energy dissipation, Engineering, *Tethered float breakwaters.

This report described laboratory experiments at one-half scale using simulated random seas and field tests at full scale of an installation of a dynamic floating breakwater system in a limited fetch situation. An analytical model was described which successfully predicted the performance of a tethered float breakwater configuration, given the incident wave spectrum. The methodology for selecting the arbitrary resistance coefficients in the predictive model was considered. Predicted and measured performance data for a total of 60 laboratory and field experiments were displayed which covered a very broad range of wave climates. (Sims-ISWS)

Field 8—ENGINEERING WORKS

Group 8B—Hydraulics

W80-00587

SAND BED FRICTION FACTORS FOR OSCILLATORY FLOWS,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2L.
W80-00734

TURBULENT FLOW IN A DEPTH-LIMITED BOUNDARY LAYER,
Washington Univ., Seattle. Dept. of Oceanography.
A. R. M. Nowell, and M. Church.
Journal of Geophysical Research, Vol. 84, No. C8, p 4816-4824, August 20, 1979. 7 fig, 43 ref.

Descriptors: *Turbulent flow, *Boundary layers, *Model studies, Mathematical models, Hydraulic models, Roughness(Hydraulic), Flow, Velocity, Reynolds number, Turbulence, Boundary processes, Turbulent boundary layers, Hydraulics.

Turbulent flow was investigated at a constant flow Reynolds number in a depth-limited boundary layer. Relative roughness was 0.12. Roughness density (ratio of plan area of elements to total bed area) was varied to cover the range of flow types described by Morris. The effect of roughness density on velocity profile shape factors, energy dissipation, and streamwise kinetic energy confirmed the existence of three types of roughness density-flow interaction, namely, 'skimming', 'wake interaction', and 'isolated roughness' flows. The velocity profiles and kinetic energy measures identified three layers in the vertical profile: an outer layer (y/D greater than 0.35), a wake layer (y/D between 0.35 and 0.10), and an inner region (y/D less than 0.10). The wake layer is produced by strong turbulent action accompanying vortex shedding at intermediate roughness densities. Spectral measurements and calculations of the turbulent macroscale indicated that the spectral shape is affected by the free surface, but that below y/D = 0.5 a parametric model using the turbulent Reynolds number in the spectral energy equation adequately describes the spectral shape for all roughness densities. Implications of these results were discussed for the study of shallow, natural flows with high relative roughness. (Sims-ISWS)
W80-00741

LABORATORY SIMULATION OF THE GYRE IN THE ALBORAN SEA,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2L.
W80-00743

8D. Soil Mechanics

BEST WAYS TO DEWATER DREDGED MATERIAL,
Oklahoma State Univ., Stillwater. Dept. of Geotechnical Engineering.
For primary bibliographic entry see Field 2G.
W80-00733

8E. Rock Mechanics and Geology

DRAINAGE NETWORK POWER,
Southampton Univ. (England). Dept. of Geography.
K. J. Gregory.
Water Resources Research, Vol. 15, No. 4, p 775-777, August 1979. 2 fig, 1 tab, 17 ref.

Descriptors: *Streams, *Networks, *Drainage systems, Geomorphology, Hydrology, Drainage, Floods, Basins, Model studies, *Stream networks, Network power, Drainage basin characteristics, Channel networks.

Although many indices of drainage basin characteristics have been devised and employed in previous studies, there is still a need to identify those indices which have an easily interpreted physical significance to be of use in explanatory models. Whereas stream power has been used in hydraulic studies of river channels, a comparable expression can be developed to denote the potential energy available in the stream network of a drainage basin. An index of drainage network power was obtained as the volume of the channel network divided by the basin relief, and this index expressed the potential energy of the network of channels in the basin. The index may be directly related to flood potential. The index was used in a study of 14 basins in Britain, and it correlated well with mean annual flood obtained from a partial duration series. (Lee-ISWS)
W80-00725

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

ALGAL BIOCHEMICAL TRICKS AND CLASSIFICATION,
Hawaii Univ., Honolulu. Sea Grant Coll. Program.
For primary bibliographic entry see Field 5C.
W80-00512

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

GLACIOLOGICAL DATA: WORKSHOP ON SNOW COVER AND SEA ICE DATA.
For primary bibliographic entry see Field 2C
W80-00566

SNOW AND ICE DATA SETS FOR CLIMATE AND WATER RESOURCE STUDIES WITH PARTICULAR REFERENCE TO NORTH AMERICA,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 2C.
W80-00567

MAPPING AND ARCHIVING OF CANADIAN SEA ICE DATA,
Atmospheric Environment Service, Downsview (Ontario).
For primary bibliographic entry see Field 7C.
W80-00569

THE UNITED STATES ENVIRONMENTAL SATELLITE DATA ARCHIVES,
National Climatic Center, Asheville, NC.
For primary bibliographic entry see Field 7B.
W80-00571

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 3
FEBRUARY 1, 1980

W80-00801--W80-01200
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 3
FEBRUARY 1, 1980

W80-00801--W80-01200

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

STATISTICAL SUMMARIES OF SURFACE-WATER-QUALITY DATA FOR SELECTED SITES IN OKLAHOMA, THROUGH THE 1975 WATER YEAR,
Geological Survey, Oklahoma City, OK. Water Resources Div.
J. K. Kurklin.
Geological Survey open-file report 79-219, May 1979. 171 p, 1 Fig, 5 Tab, 4 Ref.

Descriptors: *Water quality, *Streams, *Oklahoma, *Water analysis, *Chemical analysis, Data collections, Sampling, Sites, Regression analysis, Reviews, Statistical methods, *Value extremes.

Statistical summaries of surface-water-quality data for 47 streams in Oklahoma have been compiled. Data for the period of record through the 1975 water year at each site were used to develop regression equations for specific conductance-constituent relationships for calcium, magnesium, sodium, sodium plus potassium, bicarbonate, sulfate, chloride, silica, and dissolved solids. Tables include minimum, mean, and maximum values for selected constituents for the period of record through the 1975 water and for individual water years. (Woodard-USGS)
W80-00937

PUBLIC GROUNDWATER SUPPLIES IN CARROLL COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W80-00946

1B. Aqueous Solutions and Suspensions

PROFILING WATER QUALITY SENSING SYSTEM,
General Dynamics, San Diego, CA. Electronics Div.
For primary bibliographic entry see Field 5G.
W80-01179

2. WATER CYCLE

2A. General

ESTIMATION OF DRAINAGE DENSITY FROM TOPOLOGICAL VARIABLES,
Leicester Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W80-00953

COMPUTER APPLICATION TO DOUBLE-MASS ANALYSIS,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Resources Engineering.
For primary bibliographic entry see Field 7C.
W80-00970

THE ANNUAL WATER BALANCE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY8, Proceedings Paper 14781, p 923-941, August 1979. 9 Fig, 1 Tab, 19 Ref, 2 Append.

Descriptors: *Water balance, *Statistical analysis, *Hydrologic cycle, Rainfall, Runoff, Evaporation, Groundwater, Climatology, Vegetation, Evapotranspiration, Atmosphere, Soils, Infiltration, Equations, Analytical techniques, Hydrology, Water resources.

The average annual one-dimensional water balance was expressed for natural surfaces in terms of physically-significant dimensionless parameters. This provided the basis for dynamic similarity of the water balance and for an improved understanding of climate-soil-vegetation coupling. A sensitivity analysis pointed out the critical importance of the potential rate of evapotranspiration in defining water balance variations due to changes in other climate and soil parameters. A first-order analysis of the average annual water balance gave an equation for the annual water balance that can be used to estimate the cumulative distribution functions (cdf) of the components of the annual water balance in terms of the cdf of the annual precipitation and of observable parameters of the physical system. This provided a rational basis for assessing the risk due to physical changes in the land surface and for estimating the recurrence interval of such water balance components as basin yield. (Sims-ISWS)
W80-01018

FROST GAUGES AND FREEZING GAUGES,
Department of the Environment, Ottawa (Ontario). Water Quality Branch.
J. A. Banner, and R. O. van Everdingen.
NHRI Paper No 3, IWD Technical Bulletin No 110, 1979. 18 p, 20 Fig, 1 Tab, 9 Ref.

Descriptors: *Frost, *Freezing, *Gages, *Depth, Resistance, Leakage, Damages, Soils, Soil water, Temperature, Mathematical studies.

Several types of frost gauges to detect frost (temperatures at or below 0 C) and several types of freezing gauges to determine the occurrence and extent of soil freezing (conversion of soil moisture from liquid to solid) were designed and constructed. The multisensor electrical-resistance freezing gauges enable determination of the progress, with time, of freezing and thawing in both saturated and unsaturated soils. In the case of unsaturated materials, the use of temperature sensors or electrical-resistance or visual frost gauges makes it possible to distinguish between the resistance effects of freezing and those of drying of the soil. Computer-generated plots of resistance vs. depth and time are used in the interpretation of the data. Best results are obtained when freezing gauges with small electrode spacings, installed directly in the soil, are measured daily. (WATDOC)
W80-01170

2B. Precipitation

APPARATUS AND METHOD FOR MEASURING LIQUID WATER CONTENT OF A CLOUD OR FOG,
Office of the Secretary of the Army, Washington, DC.
H. R. Carlon.
U.S. Patent No 4,154,089, 6 p, 2 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 832, May 15, 1979.

Descriptors: *Patents, *Clouds, *Fog, *Moisture content, Meteoric water, Precipitable water, Instrumentation, Measurement, Equipment.

An apparatus and method for measuring the liquid water content of a cloud or fog utilizes an environmentally controlled test chamber having a plurality of oppositely disposed windows selected to be optically transparent at a chosen wavelength of radiation. The windows of the chamber are positioned intermediate an infrared source and a wavelength scanning radiometer. An optical band pass filter is selected to pass radiation of a specific wavelength making the instrumentation substantially independent of cloud droplet size distribution enabling the measurement of only liquid water rather than water vapor. (Sinha-OEIS)
W80-00891

ATMOSPHERIC CONTRIBUTIONS TO STREAM WATER CHEMISTRY IN THE NORTH CASCADE RANGE, WASHINGTON,
Washington Univ., Seattle. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2K.
W80-00948

A NOTE ON THE DUAL-GAGE AND WYOMING SHIELD PRECIPITATION MEASUREMENT SYSTEMS,
Science and Education Administration, Boise, ID. Northwest Watershed Research Center.
C. L. Hanson, R. P. Morris, and D. L. Coon.
Water Resources Research, Vol 15, No 4, p 956-960, August 1979. 5 Fig, 2 Tab, 11 Ref.

Descriptors: *Idaho, *Precipitation gages, *Snowfall, *Precipitation(Atmospheric), Rainfall, Gages, Winds, Gaging, Regression analysis, Measurement, *Precipitation measurement systems, *Wyoming shield, *Reynolds Creek Experimental Watershed(ID), Alter shield, Dual-gage, Windy conditions, Annual precipitation, Windswept areas.

Analysis of 52 events, which included both snowfall and rainfall, showed that the dual-gage and the Wyoming shield precipitation measuring systems measured nearly the same amounts at an unprotected site on the Reynolds Creek Experimental Watershed in southwest Idaho. These systems were developed to measure precipitation, more specifically snowfall, under windy conditions. The more legible record traces obtained from the Wyoming shield gage were a good reason for using this shield when installing precipitation gages at windy locations. (Roberts-ISWS)
W80-00957

RELATIONSHIP BETWEEN PRECIPITATION AND TORNADO ACTIVITY,
National Severe Storms Forecast Center, Kansas City, MO.
J. G. Galway.
Water Resources Research, Vol 15, No 4, p 961-964, August 1979. 7 Fig, 4 Tab, 12 Ref.

Descriptors: *Precipitation(Atmospheric), *Tornadoes, *Correlation analysis, Rainfall, Droughts, Time series analysis, Data processing, Weather, Meteorology, Climatology, Statistics.

Precipitation and tornado statistics for three different geographic areas were compared. Weak correlations exist between yearly and seasonal precipitation totals and tornadic activity. Also, a slight trend for wet years to have more tornadoes than dry ones is present. However, tornadic activity does not appear to be related to the existence of drought. (Sims-ISWS)
W80-00958

ECONOMICS OF WEATHER MODIFICATION: A REVIEW,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 6B.
W80-01008

HYDROMETEOROLOGICAL CHARACTERISTICS OF SEVERE RAINSTORMS IN ILLINOIS,
Illinois State Water Survey, Urbana.
F. A. Huff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110406. Report of Investigation 90, 1979. 6 Fig, 15 Tab, 13 Ref.

Descriptors: *Climatology, *Meteorology, *Illinois, *Storms, *Data collections, Rainfall intensity, Areal, Rainfall disposition, Movement, Shape, Analysis, Distribution, Probable maximum precipitation, Frequency, Temporal distribution, Depth-area-duration analysis, Seasonal, Probability, Time, Rainfall frequency, Severe rainstorms.

This report provided a summary of available information on heavy rainstorms in Illinois obtained from analyses of data from various sources. These data included climatological records of the National Weather Service, field surveys of severe rainstorms by the State Water Survey, and data collected from operation of several dense raingage networks in the state beginning in 1948. The major objective was to provide information useful in

hydrologic design projects. Primary emphasis was placed on the frequency distribution of areal mean rainfall in severe rainstorms having durations of 6 to 48 hours and producing excessive amounts over areas of 25 to 10,000 square miles. However, information was also provided on other important storm factors, such as their shape, orientation, movement, and time distribution characteristics. (Humphreys-ISWS)
W80-01009

MAP SKEW,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01026

PRE-MONSOON RAINFALL AND ITS VARIABILITY IN BANGLADESH: A TREND SURFACE ANALYSIS,
Windsor Univ. (Ontario). Dept. of Geography.
M. Sanderson, and R. Ahmed.
Hydrological Sciences Bulletin, Vol 24, No 3, p 277-287, September 1979. 9 Fig, 1 Tab, 9 Ref.

Descriptors: *Monsoons, *Rainfall, *Precipitation(Atmospheric), Variability, Surfaces, Foreign countries, Foreign research, Surface drainage, Agriculture, Crops, Foods, Watersheds(Basins), *Trend surface analysis, *Bangladesh, Food crisis, Inventory, Crop acreage.

Bangladesh, with its small but rich agricultural land (total area 9 million ha) and large population (80 million), is faced with an acute food crisis. The economy of Bangladesh is dependent mainly upon agriculture which, in turn, is dependent upon rainfall. An increase in crop acreage and productivity during the pre-monsoon season, March to May, offers a partial solution to the problem. The water available from the rainfall of this season could be utilized through proper planning for better agricultural uses. The present study was an attempt at an inventory of such pre-monsoon rainfall, both monthly and seasonally, and its variability over time and space. The technique employed was that of trend surface mapping. (Roberts-ISWS)
W80-01032

PARTIAL DROUGHT CONDITIONS IN NEPAL,
Ground Water Resources Development Board, Kathmandu (Nepal).
C. K. Sharma.
Hydrological Sciences Bulletin, Vol 24, No 3, p 327-333, September 1979. 5 Fig, 10 Ref.

Descriptors: *Droughts, *Monsoons, *Climates, Mountains, Precipitation(Atmospheric), Moisture, Soil erosion, Silting, Landslides, Foreign countries, Foreign research, *Partial droughts, *Nepal, *India, *Himalayas, Westerlies, Winter precipitation, Westerly rainfalls, Deforestation, Famine.

Partial drought conditions are found in space and time in the mountainous country of Nepal, a landlocked country situated in the middle of the Himalaya Mountains. This area experiences monsoons in July and the westerlies in January, but even when the winter precipitation comes on time, the planted wheat crop can not give a sufficient yield as the moisture in the soil dries up very fast before the crop matures. Only artificial irrigation by canal or groundwater developments can combat drought in Nepal. At some places, hot winds and dust storms are frequent, and some areas of Nepal are in the grip of drought between the end of March and the beginning of the monsoon in July. Sometimes wells are dry and drinking water is a problem. The main solution to drought in Nepal is the conservation of water resources and the reduction of evaporation from the soil as well as evaporation from reservoirs. No means to achieve these results were suggested, although it was thought that the development of groundwater resources could combat a continuous drought for a period of two to three years. (Roberts-ISWS)
W80-01033

RADAR MEASUREMENT OF RAINFALL--A SUMMARY,
National Center for Atmospheric Research, Boulder, CO.
J. W. Wilson, and E. A. Brandes.
Bulletin of the American Meteorological Society, Vol 60, No 9, p 1048-1058, September 1979. 6 Fig, 3 Tab, 78 Ref.

Descriptors: *Rainfall, *Radar, *Remote sensing, Reviews, Precipitation(Atmospheric), Rain gages, On-site investigations, Theoretical analysis, Sampling, Statistics, Statistical methods, Storms, Thunderstorms, Flash floods, Measurement, Calibrations, Meteorology, Radar-rainfall relationships.

Radar can produce detailed precipitation information for large areas from a single location in real time. Although radar has been used experimentally for nearly 30 years to measure rainfall, operational implementation has been slow. Today, data are underutilized, and both confusion and misunderstanding exist about the inherent ability of radar to measure rainfall, about factors that contribute to errors, and about the importance of careful calibration and signal processing. Areal and point rainfall estimates are often in error by a factor of 2 or more. Error sources reside in measurement of radar reflectivity factor, evaporation and advection of precipitation before reaching the ground, and variations in the drop-size distribution and vertical air motions. Nevertheless, radar can be of lifesaving usefulness by alerting forecasters to the potential for flash flooding. The most successful technique for improving the radar rainfall estimates has been to 'calibrate' the radar with rain gages. Simple techniques that combine sparse gage reports (one gage per 1000-2000 sq km) with radar produce smaller measurement errors (10-30%) than either system alone. When high accuracy rainfall measurements are needed (average error less than about 10-20%), the advantage of radar is diminished since the number of gages required for calibration is itself sufficient to provide the desired accuracy. (Sims-ISWS)
W80-01036

THE FRONTIERS PLAN: A STRATEGY FOR USING RADAR AND SATELLITE IMAGERY FOR VERY-SHORT-RANGE PRECIPITATION FORECASTING,
Royal Signals and Radar Establishment, Malvern (England). Radar Research Lab.
K. A. Browning.
The Meteorological Magazine, Vol 108, No 1283, p 161-184, June 1979. 6 Fig, 16 Ref.

Descriptors: *Weather forecasting, *Precipitation(Atmospheric), *Radar, *Satellites(Artificial), Rainfall, Storms, Remote sensing, Forecasting, Data processing, Computers, Data collections, Weather, Meteorology, *England.

The FRONTIERS program described in this article addresses the problem of analyzing and forecasting the detailed pattern of precipitation over the period 0-6 hours ahead. The acronym FRONTIERS embodies the following key elements: Forecasting Rain Optimized using New Techniques of Interactively Enhanced Radar and Satellite. In this program, a whole-system design approach was adopted, with digital data handling all the way from the observational input to the disseminated forecast product. The crucial role of human judgement which is required to make up for the limitations of the observational data and the incompleteness of our understanding on the mesoscale was emphasized. In the plan discussed here, the data from a network of radars and a geostationary satellite are composited on an interactive video display, and the forecaster does his analysis and forecasting by modifying what is on the television screen while preserving the basic data in store. The resulting screenful of digital information can then be tailored and disseminated promptly to users without further manual effort. Although the emphasis in this paper was on the accurate analysis of current weather and extrapolation of current trends, these methods must be considered in the context of an eventual forecast system incorporating a mesoscale numerical model. (Sims-ISWS)
W80-01038

2C. Snow, Ice, and Frost

GLACIER SURVEYS IN BRITISH COLUMBIA-1976,
Department of the Environment, Ottawa (Ontario). Water Quality Branch.
I. A. Reid, and J. O. G. Charbonneau.
Report Series No 63, 1979, 21 p, 10 Fig, 5 Maps, 35 Tab, 9 Ref.

Descriptors: *Glaciers, *Surveys, *Streamflow, *Surface drainage, *Water resources, Mapping, Data collections, *British Columbia, Sentinel Glacier, Sphinx Glacier, Nadahini Glacier, Kokanee Glacier, Bugaboo Glacier, Photogrammetric survey techniques.

Glaciers act as natural regulators, storing water in winter and releasing it in summer. To gain some understanding of this phenomenon and the contribution which glaciers make to streamflow, the predecessors of the Water Survey of Canada began glacier surveys in 1945. The earlier surveys offered some clue to the role of the glacier, but the data collected were not sufficient to provide the overall picture. Following adoption of photogrammetric survey techniques, however, the glacier surveys have evolved to the extent that it is now feasible to produce a series of maps from which the linear, areal, directional and volumetric changes can be determined. The surveys have revealed that the glaciers, in general, are becoming smaller in size; hence the regulating effect on streamflow is diminishing. (WATDOC)
W80-01169

2D. Evaporation and Transpiration

AN IMPROVED AERODYNAMIC EVAPORATION TECHNIQUE FOR LARGE LAKES WITH APPLICATION TO THE INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
F. H. Quinn.
Water Resources Research, Vol 15, No 4, p 935-940, August 1979. 2 Fig, 6 Tab, 18 Ref.

Descriptors: *Lake Ontario, *Evaporation, *Great Lakes, Technology, Mass transfer, Lakes, Winds, Bulk density, Boundary layers, Air-water interfaces, *Aerodynamic evaporation technique, *Lake Hefner, International Field Year, Bulk transfer technique, Bulk transfer coefficient, Wind speed gradient, Mass transfer equation.

An improved bulk transfer technique was developed for large-lake evaporation. The technique is based upon recent boundary layer research near the air-water interface. A variable bulk transfer coefficient, dependent upon atmospheric stability, is given as a function of the nondimensional wind speed gradient, the potential temperature gradient, and the Monin-Obukhov length. The technique, which requires the same data as the simplified mass transfer equation, can be applied to large lakes throughout the world. This technique was applied to the Lake Ontario data set collected during the International Field Year for the Great Lakes. The inclusion of stability increased calculated evaporation during the unstable high-evaporation months and decreased calculated condensation during the stable late spring months to more realistic levels. Comparisons between the Lake Hefner mass transfer equation and the technique recommended here indicated that the mass transfer equation may have overestimated Lake Ontario evaporation by approximately 20%. (Roberts-ISWS)
W80-01029

2E. Streamflow and Runoff

EARLY FLOOD WARNING SYSTEM,
A. R. Permut, A. A. Permut, and R. M. Permut.
U.S. Patent No 4,153,881, 13 p, 4 Fig, 4 Ref;

Official Gazette of the United States Patent Office, Vol 982, No 2, p 744, May 8, 1979.

Descriptors: *Patents, *Warning systems, *Flood forecasting, *Electronic equipment, Remote control, Gages, Water level, Data processing, Hazards, Rainfall, Radio communication systems, Flash floods, Early flood warning system.

An Early Flood Warning System provides advanced warning of probable flash floods and/or stage floods to potential flood victims by collecting and analyzing rainfall and stream level data, and by providing means for disseminating alarms and instructions to individuals in threatened areas. The Early Flood Warning System contains: automatic electronic digital liquid level gauges, some of which are specially adapted as stream level gauges; gauge actuated transmitters; a receiver; a decoder and validity logic unit; a data analysis unit; a central disaster alert station; and a number of disaster alert modules. The digital liquid level gauges are energy and environmental intensive devices which electronically measure, using digital techniques, liquid levels such as rainfall and stream level, and transmit data by coded radio frequency (R.F.) signals to a central data analysis facility. The digital liquid level gauges are remotely located and independent of each other. (Sinha-OEIS)
W80-00889

LOW-FLOW CHARACTERISTICS OF WISCONSIN STREAMS AT SEWAGE-TREATMENT PLANTS AND INDUSTRIAL PLANTS,
Geological Survey, Madison, WI. Water Resources Div.
B. K. Holmstrom.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 688, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-31, March 1979. 123 p, 2 Fig, 32 Tab, 36 Ref.

Descriptors: *Low flow, *Streamflow, *Flow characteristics, *Base flow, *Wisconsin, Sewage effluents, Industrial wastes, Water quality standards, Gaging stations, Low-flow frequency, Low-flow partial-record stations.

Low-flow characteristics of Wisconsin streams at sewage-treatment and industrial plants are presented. The low-flow characteristics are needed to implement water-quality standards for all surface waters of the State. Water-quality standards in Wisconsin are based on the annual minimum 7-day mean flow below which the flow will fall on the average of once in 10 years (Q7,10). Low-flow characteristics are included for streams at 397 sewage-treatment plants and 143 industrial plants in 30 river basins. The low-flow characteristics presented are the annual minimum 7-day mean flow below which the flow will fall on the average of once in 2 years (Q7,2) and the Q7,10. The Q7,2 values ranged from 0 to 3,770 cubic feet per second and Q7,10 values ranged from 0 to 2,790 cubic feet per second. (Woodard-USGS)
W80-00930

ASSESSMENT OF FITTING TECHNIQUES FOR THE LOG PEARSON TYPE 3 DISTRIBUTION USING MONTE CARLO SIMULATION,
Queen's Univ., Kingston (Ontario).
M. J. Nozdryn-Plotnicki, and W. E. Watt.
Water Resources Research, Vol 15, No 3, p 714-718, June 1979. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Flood frequency, *Probability, *Annual peak discharge, *Methodology, *Stochastic hydrology, Monte Carlo method, Statistical models, Analytical techniques, Model studies, *Log Pearson type 3 distribution, *Skewness, Generation algorithm, Statistical efficiency, Maximum likelihood method, Method of moments.

The distribution parameter space, as defined by annual maximum floods at 37 long-term Canadian flow-gaging stations, was used to derive log Pearson type 3 independent variates. The generated variates were divided into sets of 25-, 50-, and 100-year samples. For each sample, parameters and specific recurrence-interval floods were estimated by using three techniques: the method of maximum likelihood, the method of moments, and a method which preserves the moments of the untransformed flows. The parameter estimates were generally very poor; they were highly biased and exhibited large variances. However, there was no significant bias in 50- and 100-year flood estimates. On the basis of statistical efficiency, no one method was superior for the whole of the parameter space. The exressions for the standard error of the T-year flood were found to be biased for N equal to 25, 50, and 100 years. In general, the asymptotic maximum likelihood relation gave underestimates, whereas the moments relation gave overestimates. (Singh-ISWS)
W80-00947

ESTIMATION OF DRAINAGE DENSITY FROM TOPOLOGICAL VARIABLES,
Leicester Univ. (England). Dept. of Geography.
V. Gardiner.
Water Resources Research, Vol 15, No 4, p 909-917, August 1979. 5 Fig, 8 Tab, 42 Ref.

Descriptors: *Geomorphology, *Drainage density, *Model studies, Sampling, Drainage, Geology, Hydrology, Watersheds(Basins), Estimating, Streams, Mathematical studies, *Stream networks, *Devon(England), *England, Grid square drainage density, Principal component analysis, Land form, Stream length.

Existing methods for the estimation of drainage density are generally inadequate, being either laborious or expensive or of low effectiveness. Methods were examined by which grid square drainage density may be estimated from topological variables; a sample of 400 grid squares from Devon, England, was used in the study. Principal components analysis of these data yields interpretable components that allow prediction of 82% of the total variation in stream length, employing a multiple relationship. A simple regression relationship affords prediction of 68% of the variation in stream length. The mode of sampling employed and the use of polynomial regression do not markedly change the effectiveness of these relationships, and sufficient published work exists to suggest that the method may be widely applicable. (Lee-ISWS)
W80-00953

EXPERIMENTS IN LONGITUDINAL DISPERSION WITH DEAD ZONES,
Ministry of Works and Development, Wellington (New Zealand).
For primary bibliographic entry see Field 8B.
W80-00973

PRELIMINARY IDENTIFICATION OF PRICE RIVER BASIN SALT PICK-UP AND TRANSPORT PROCESSES,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2J.
W80-00981

TRANSFER COEFFICIENTS IN STRATIFIED CHANNEL FLOW,
Nevada Univ. System, Las Vegas. Desert Research Inst.
R. H. French.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14808, p 1087-1101, September 1979. 7 Fig, 2 Tab, 18 Ref, 2 Append.

Descriptors: *Stratified flow, *Open channel flow, *Turbulent flow, *Laboratory tests, Model studies, Hydraulic models, Flumes, Density stratification, Saline water-freshwater interfaces, Flow, Shear, Turbulence, Transfer, Water transfer, Mixing, Equations, Theoretical analysis, Transfer coefficients.

Empirical equations based on laboratory data were developed to predict the turbulent momentum and solute transfer coefficients in stratified open channel flows. In flows where the primary source of turbulence was the bottom boundary and the density stratification was continuous, a high degree of correlation was found to exist between the momentum transfer coefficient and a bulk Richardson number based on the shear velocity, the depth of flow, the average density, and the maximum change in density across the flow. The degree of correlation between the solute transfer coefficient and this Richardson number was not as high. Although several limitations were noted, the work represents an improvement over alternative theories. (Sims-ISWS)
W80-01022

ESTIMATING AVERAGE VELOCITY IN GRAVEL-BED RIVERS,
New Brunswick Univ., Fredericton. Dept. of Civil Engineering.
D. I. Bray.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14810, p 1103-1122, September 1979. 3 Fig, 6 Tab, 19 Ref.

Descriptors: *Channels, *Gravels, *River beds, Estimates, Friction, Rivers, Hydraulics, Roughness(Hydraulic), Streamflow, Velocity, On-site investigations, *Fluvial hydraulics, Computation, Friction factors.

Basic data from 67 gravel bed river reaches in Alberta, Canada, were used to test widely adopted equations for computing average velocity in natural channels for the case of relatively high in-bank flows. Relations proposed by Cowan, Strickler, and Limerinos to estimate Manning's n were tested. The equations of the form presented by Keulegan and Lacey for computing average velocity also were evaluated. Computations based on these methods indicated that the Limerinos-Manning equation is the most acceptable approach for estimating average velocity in gravel-bed river reaches. The Lacey equation provides satisfactory results if no bed material data are available. The basic data also were used to develop best-fit relationships for computing Manning's n and the friction factor for gravel-bed river reaches. Particular emphasis was placed on an evaluation of the significance of bed material data in equations used to compute average velocity in gravel-bed river reaches. (Lee-ISWS)
W80-01023

HYDROLOGIC GENERATING MODEL SELECTION,
Waterloo Univ. (Ontario). Dept. of Systems Design.
K. W. Hipel, E. A. McBean, and A. I. McLeod.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 105, No WR2, Proceedings Paper 14817, p 223-242, September 1979. 2 Fig, 2 Tab, 45 Ref, 2 Append.

Descriptors: *Mathematical models, *Canada, *River flow, *Reservoir design, Model studies, Stochastic processes, Simulation analysis, Flow, Rivers, Reservoirs, Costs, Cost-benefit analysis, Decision making, Planning, Hydrology, *South Saskatchewan river(Canada).

When modeling seasonal river flows for generating possible flow sequences for use in reservoir design, it is often necessary to first invoke a deterministic transformation to remove seasonality, and thus eliminate the need for differencing. To select which stationary stochastic model to fit to the resulting transformed data, a two-stage decison-making process was recommended. The first stage consists of eliminating those models which do not possess a proper statistical fit to the data, while further discrimination can be done at the second stage by judging the remaining models according to the economic criteria of the particular reservoir design. Simulation procedures were used to obtain designs using various hydrologic generating models for a hydroelectric reservoir complex on the South Saskatchewan River in Canada. Both Box-Jenkins and Fractional Gaussion noise processes were considered in the model selection studies. A new simulation procedure was developed

for use with a Fractional Gaussian noise model. (Sims-ISWS)
W80-01025

MAP SKEW,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 105, No WR2, Proceedings Paper 14840, p 269-277, September 1979. 2 Fig, 3 Tab, 4 Ref, 1 Append.

Descriptors: *Flood frequency, *Runoff, *Statistical analysis, Floods, Mapping, Statistics, Excessive precipitation, Precipitation(Atmospheric), Rainfall, Hydrographs, Climatology, Hydrology, *Skewness.

Flood frequency estimation using the recommended log-Pearson type III analysis requires an estimate of the skew coefficient. The sample estimate of skewness may be inaccurate when the record length is small. A generalized estimate obtained using regional data provides an alternative estimate, the accuracy of which is difficult to evaluate. An analysis of the standard error of estimate of the skew map recommended in the Water Resources Council in Bulletin 17 was shown to be relatively large and not significantly different from the standard error of estimates obtained from annual flood series. A weighted estimate of the skew coefficient should provide more accuracy, providing that the weighting scheme is designed to minimize the error variance. (Sims-ISWS)
W80-01026

URBAN RUNOFF POLLUTION METHOD,
GKY and Associates, Inc., Alexandria, VA.
For primary bibliographic entry see Field 5B.
W80-01027

FORCED FORTNIGHTLY TIDES IN SHALLOW RIVERS,
British Columbia Univ., Vancouver. Dept. of Oceanography.
P. H. LeBlond.
Atmosphere-Ocean, Vol 17, No 3, p 253-264, 1979. 6 Fig, 1 Tab, 9 Ref.

Descriptors: *Rivers, *Tides, *Water levels, *St. Lawrence River, Shallow water, Water level fluctuations, Theoretical analysis, Mathematical studies, Mathematical models, Model studies, Runoff, Tidal effects, Sea level.

The presence and the basic features of the forced fortnightly wave observed in some shallow rivers were explained through scaling arguments which showed that this wave is generated by the fortnightly modulation of the frictional forces due to the variation in tidal velocities. Comparison of the results with sea level records from a shallow reach of the St. Lawrence River showed reasonable agreement between data and theory. (Sims-ISWS)
W80-01031

2F. Groundwater

DISTRIBUTION OF GROUND-WATER WITHDRAWALS ON LONG ISLAND, NEW YORK, IN 1973 BY AREA, AQUIFER, AND USE,
Geological Survey, Syosset, NY. Water Resources Div.
F. Erlichman.
Long Island Water Resources Bulletin 10, 1979. 16 p, 6 Fig, 1 Plate, 2 Tab, 18 Ref.

Descriptors: *Groundwater, *Water supply, *Withdrawal, *Water utilization, *Aquifers, Water demand, Land use, Land development, Water distribution(Applied), Maps, *Long Island(NY).

Use of ground water on Long Island has increased dramatically with continued eastward urbanization and population growth. Annual total ground-water withdrawals for all uses have increased steadily since the 1880's to 496 million gallons per day (Mgal/d) in 1973. Public-supply withdrawals in 1973 accounted for 75 percent of this total; commercial-industrial withdrawals accounted for 23 percent, and agricultural withdrawals 2 percent. Total withdrawals on Long Island more than doubled between 1940 and 1973, from about 220 to 496 Mgal/d. From 1952 to 1973, public-supply withdrawals increased by more than 50 percent, from 144 to 374 Mgal/d: most of this increase was from the Magothy aquifer. Pumping density decreases eastward, in direct proportion to population density. The greatest pumping density is in urban Queens County; the smallest is in eastern Suffolk County. The greatest rate of increase in groundwater withdrawals today (1973) on Long Island is in western and central Suffolk County, where development and urbanization are taking place at the fastest rate. Withdrawals during 1973 are reported by use, county, and source aquifer. Maps showing areal distribution of public-supply withdrawals by source aquifer in 1973 and 1952 are included for comparison. (Woodard-USGS)
W80-00922

GROUND-WATER CONDITIONS IN THE EUREKA AREA, HUMBOLDT COUNTY, CALIFORNIA, 1975,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. J. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 577, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-127, December 1978. 45 p, 9 Fig, 6 Tab, 36 Ref.

Descriptors: *Groundwater resources, *Water wells, *Aquifers, *Water yield, *Water quality, Water utilization, Water supply, Groundwater availability, Water levels, Hydrogeology, Groundwater recharge, Surface-groundwater relationships, Saline water-freshwater interfaces, *California, *Humboldt County(CA), *Eureka Area(CA).

Ground-water conditions in the Eureka area, Calif., were evaluated during 1975 to determine whether significant changes had occurred since 1952, when an earlier reconnaissance was made. No major changes in water levels or water quality were noted at 1975 pumping rates. Recharge to the ground-water system compensates for both artificial and natural discharge. The position of the freshwater-saltwater transition zone underlying the alluvial flood plains in the summer of 1975 were unchanged from those in 1952. Ground water continues to be used principally for irrigation on the alluvial flood plains of the Eel and Mad Rivers. In 1975, about 425 irrigation wells supplied an estimated 24,000 acre-feet of ground water to the Eureka area; half of those wells were located on the Eel River flood plain. The estimated total ground-water pumpage for irrigation, industry, public supply, domestic use, and livestock was 27,500 acre-feet. During the irrigation season, there is a higher rate of recharge from the rivers which helps to maintain ground-water storage and stabilize the freshwater-seawater transition zone. (Woodard-USGS)
W80-00926

MAPS SHOWING GROUND-WATER CONDITIONS IN THE NEW RIVER-CAVE CREEK AREA, MARICOPA AND YAVAPAI COUNTIES, ARIZONA--1977,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-00933

CONFIGURATION OF THE TOP OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND ADJACENT AREAS,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-00934

A DIGITAL MODEL FOR SIMULATION OF GROUND-WATER HYDROLOGY IN THE HOUSTON AREA, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-00935

GROUNDWATER LEVELS IN NEBRASKA, 1978,
Nebraska Univ., Lincoln. Div. of Conservation and Survey; and Geological Survey, Lincoln, NE. Water Resources Div.
D. T. Pederson, and M. S. Johnson.
Nebraska Water Survey Paper No 49 July 1979. 116 p, 25 Ref.

Descriptors: *Groundwater, *Water wells, *Water level fluctuations, *Nebraska, Hydrographs, Water table, Withdrawal, Groundwater recharge, Observation wells.

This report summarizes data about groundwater-level changes in Nebraska during 1978 and includes other information pertinent to the water-level measurement program. The amounts of change from predevelopment water levels are shown on maps, and hydrographs are used to show trends in water-level changes. Also described are availability of data on water levels, changes in the water-level measurement program during the year, and the two major causes of water-level changes--recharge from precipitation and withdrawal of ground water. (Woodard-USGS)
W80-00936

STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
E. T. Baker Jr.
Texas Department of Water Resources Report 236, July 1979. 43 p, 1 Fig, 1 Tab, 34 Ref.

Descriptors: *Stratigraphy, *Hydrogeology, *Geologic mapping, *Aquifers, *Texas, Coastal plains, Geologic units, Geologic time.

The subsurface delineation of hydrogeologic units of Miocene and younger age and stratigraphic units of Paleocene to Holocene age establishes an interrelationship of these units statewide across much of the Coastal Plain of Texas. The 11 dip sections and 1 strike section, which extend from the land surface to 7,600 feet below sea level, provide continuity of correlation from the outcrop to the relatively deep subsurface. Sand containing water with less than 3,000 milligrams per liter of dissolved solids, which is shown on the sections, serves as an index of water availability of this quality. (Woodard-USGS)
W80-00938

GEOHYDROLOGY OF BROOKS, LOWNDES, AND WESTERN ECHOLS COUNTIES, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
R. E. Krause.
Geological Survey Water-Resources Investigations 78-117 (open-file report), June 1979. 48 p, 18 Fig, 8 plates, 2 Tab, 39 Ref.

Descriptors: *Hydrogeology, *Groundwater resources, *Water quality, *Aquifer characteristics, *Surface-groundwater relationships, Artesian aquifers, Water wells, Water yield, Groundwater recharge, Karst, Water level fluctuations, Water analysis, Chemical analysis, Hardness(water), Iron, Strontium, Specific conductivity, Hydrogen sulfide, Sulfates, Color, Georgia, *Valdosta area(Ga).

The principal artesian aquifer, a limestone of Eocene to Miocene age, is the main source of water supply for Brooks, Lowndes, and western Echols Counties in south Georgia. Pumpage of about 22 million gallons perday from this prolific aquifer has not posed any problems regarding declining water levels or depletion of the reservoir.

However, water-quality problems do occur in the Valdosta area. Seepage-run measurements indicate that the Withlacoochee River north of Valdosta contributes an average of 112 cubic feet per second of water to caverns and sinkholes that recharge the aquifer. Wells near the recharge area withdraw relatively unfiltered water with iron concentration and color intensity exceeding standards for drinking water. South of Valdosta, water from the aquifer contains as much as 3.0 milligrams per liter of hydrogen sulfide, rendering the water unfit for drinking. Water high in sulfate concentration occurs below 550 feet in the lower part of the aquifer in Valdosta, and is assumed to be present at that depth throughout the study area. Generally, sufficient quantities of freshwater can be obtained without drilling to this depth. (Woodard-USGS)
W80-00941

PUBLIC GROUNDWATER SUPPLIES IN CARROLL COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W80-00946

UNSTEADY FLOW IN CONFINED AQUIFERS: A COMPARISON OF TWO BOUNDARY INTEGRAL METHODS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
J. A. Liggett, and P. L.-F. Liu.
Water Resources Research, Vol 15, No 4, p 861-866, August 1979. 7 Fig, 11 Ref.

Descriptors: *Unsteady flow, *Analytical techniques, *Groundwater, *Model studies, Numerical analysis, Aquifers, Artesian aquifers, Mathematical models, Equations, *Integral equations, Laplace transforms.

The boundary integral equation method (BIEM) was used for the solution of unsteady flow in confined aquifers. Such flows were described by a diffusion equation. Two approaches were presented. The first method removed the time derivatives with a Laplace transform first and solved an associated equation with the BIEM for several values of the transform parameter. A numerical transform inversion was then used to express the results in physical terms. The second method solved the differential equation directly with the BIEM. Both of these techniques were compared to the exact solutions of two simple problems. The Laplace transform method was found to be superior for general use, although the direct method was simpler and required less judgment on the part of the analyst. (Adams-ISWS)
W80-00949

PERSPECTIVE ON 'DELAYED YIELD',
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
S. P. Neuman.
Water Resources Research, Vol 15, No 4, p 899-908, August 1979. 1 Fig, 38 Ref.

Descriptors: *Specific yield, *Water table aquifers, *Theoretical analysis, *Drawdown, *Storage coefficient, Aquifers, Mathematical models, Equations, Graphical analysis, Curves, Equations, Wells, Water table, *Delayed yield.

The phenomenon of 'delayed yield' has received wide attention in the literature during recent years. Considerable work has been devoted to the development of physically based mathematical models capable of successfully reproducing observed aquifer behavior. As a result of this effort, there appears to be at present a consensus of opinion among the main contributors to the theory of delayed yield as to an acceptable physical and mathematical interpretation of this phenomenon. In spite of this apparent consensus of opinion, there is still a considerable amount of controversy in the literature about some fundamental aspects of unconfined well hydraulics. The outstanding issues concern the physical assumptions underlying various delayed yield models, changes in the flow regime of an unconfined aquifer as a function of radial distance from the pumping well, the relationship between Boulton's alpha and other physical characteristics of the aquifer, the validity of conditions required in order to represent unconfined flow by integrodifferential equations, and the behavior of unconfined aquifers at large values of time. The present paper offered a perspective on these and other related issues. (Visocky-ISWS)
W80-00952

INFLUENCE OF COVER SLAB DIAMETER ON SOLUTE TRAVEL TIME TO WELLS,
Iowa State Univ., Ames. Dept. of Agronomy.
D. Kirkham, and M. O. Sotres.
Water Resources Research, Vol 15, No 4, p 941-948, August 1979. 5 Fig, 2 Tab, 6 Ref, 2 Append.

Descriptors: *Travel time, *Solutes, *Groundwater movement, *Water wells, Steady flow, Observation wells, Water table aquifers, Flow nets, Potential flow, Hydraulic conductivity, Pollutants, Mathematical models, Equations, Model studies, Well cover slab.

Travel times were computed for solute, moving by assumed piston flow, in steady state along streamlines in a phreatic (water table) aquifer in which a tube well is located to determine the influence of a well cover slab on the travel times. Flow nets were first computed by potential theory; then travel times along sets of streamlines were derived for 12 geometries. Parameters were cover slab radius, screened and unscreened casing depth, thickness of aquifer, well radius, and radius of influence. For example, for a well of cover slab radius 1.8 m, screened casing depth 0.5 m, unscreened casing depth 1.5 m, thickness of aquifer 6 m, well radius 0.6 m, and radius of influence 30 m, hydraulic conductivity 35 m/d, head difference across the system 0.15 m, and aquifer porosity 0.25, the travel time for solute injected at the edge of the cover slab to reach the well is 5.4 days, whereas solute introduced at the top of the aquifer next to the well pipe with no cover slab is 0.17 day (4.1 hours). The longer travel time, 5.4 days versus 0.17 day for 'no cover slab,' provides a longer time for biochemical and biophysical degradation of the solute, which may be pollutants as nitrates and acids originating from agriculture, industry, strip mines, sanitary landfills, or other groundwater pollution sources near a well. (Visocky-ISWS)
W80-00955

A NEW NUMERICAL METHOD FOR SOLVING THE SOLUTE TRANSPORT EQUATION,
Analytic Sciences Corp., Reading, MA.
B. Ross, and C. M. Koplik.
Water Resources Research, Vol 15, No 4, p 949-955, August 1979. 6 Fig, 1 Tab, 13 Ref. DOE W-7405-ENG-48.

Descriptors: *Groundwater movement, *Solutes, *Pollutants, *Path of pollutants, Groundwater, Water pollution, Model studies, Mathematical models, Numerical analysis, Porous media, Subsurface flow, Subsurface waters, Waste disposal, Hydrology, *Solute transport.

The solute transport equation can be solved numerically by approximating the water flow field by a network of stream tubes and using a Green's function solution within each stream tube. Compared to previous methods, this approach permits greater computational efficiency and easier representation of small discontinuities, and the results are easier to interpret physically. The method has been used to study hypothetical sites for disposal of high-level radioactive waste. (Sims-ISWS)
W80-00956

SOIL WATER HYSTERESIS AS A CAUSE OF DELAYED YIELD FROM UNCONFINED AQUIFERS,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
H. Bouwer.
Water Resources Research, Vol 15, No 4, p 965-966, August 1979. 1 Fig, 9 Ref.

Descriptors: *Hysteresis, *Specific yield, *Water table aquifers, Moisture content, Soil water, Storage coefficient, Capillary action, Water table, Aquifers, Wells, Pumping, Vadose water, *Delayed yield.

Hysteresis in the relation between soil water content and (negative) pressure head of the soil water produces a lag in the release of pore water from a rewetted soil when the pressure heads are lowered (made more negative). For an unconfined aquifer, this means that the water table must drop some distance in response to pumping a well before pore water is fully released, if the water table prior to pumping had been rising. Since water tables around active wells usually have been rising before a pumping test is performed (to establish equilibrium), soil water hysteresis may well be a common cause of delayed yield from unconfined aquifers. (Visocky-ISWS)
W80-00959

THE EFFECTS OF URBANIZATION ON GROUND-WATER QUALITY--A CASE STUDY,
Wisconsin Univ. -Madison. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W80-00965

PREVALENCE OF ENTEROVIRUSES IN GROUND WATER OF ISRAEL,
Ministry of Health, Tel Aviv (Israel). Central Virus Lab.
For primary bibliographic entry see Field 5A.
W80-00966

AQUIFER DIFFUSIVITY FROM NOISY BOUNDARY DATA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
B. Sagar, and S. R. Singh.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY8, Proceedings Paper 14765, p 943-954, August 1979. 4 Fig, 2 Tab, 15 Ref, 2 Append.

Descriptors: *Aquifers, *Diffusivity, *Statistical analysis, *Mathematical models, Model studies, Groundwater, Streams, Boundary processes, Data processing, Statistics, Stochastic processes, Hydraulic gradient, Water levels, Water resources, Error analysis.

In this paper, the statistical properties of diffusivity were worked out from certain assumed statistical information on data. Use was made of an explicit solution described by the writers for diffusivity in a stream-aquifer system with an overspecified boundary condition. It was assumed that both the river stage hydrograph and the hydraulic gradient contain independent Gaussian noise. It was then determined that the diffusivity is the ratio of the square of two independent normal random variables. The dependence of mean value and standard deviation of diffusivity on various levels of errors in boundary data was computed and plotted. It was found that while the expected value of diffusivity does not vary much, the standard deviation increases at a fast rate as the errors in data increase. It is possible to find limits on errors in data for obtaining diffusivity estimates of certain reliability. (Sims-ISWS)
W80-00971

SOME EFFECTS OF GROUNDWATER EXTRACTION IN THE WESTERN PART OF THE NETHERLANDS ON THE HYDROLOGICAL REGIME,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands).
G. J. Heij.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No 123, International Association of Hydrological Sciences, p 167-178, 1977. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Groundwater, *Urbanization, *Hydrogeology, *Effects, Infiltration, Withdrawal, Seepage, Land subsidence, Analytical techniques,

Mathematical models, Groundwater movement, Potentiometric level, Head loss, Hydraulic conductivity, Foreign research, *Hydrologic regime, *The Netherlands.

In this paper, particular attention was paid to the consequences of lowering the hydraulic head through the extraction of groundwater, while Broeze and Couwenhoven (1977) dealt with the consequences of the lowering of the groundwater table. The influence of the extraction of groundwater on deep groundwater flow may be calculated with formulas for radial-symmetrical flow. The cutting of the Amsterdam-Rijncanal was used as an example to obtain an impression of the influence on the groundwater regime by cutting a canal and to examine some of the consequences of lowering the groundwater head by extraction, such as changes in seepage and infiltration and settlement of semipermeable layers. Finally, attention was given to the possibility of reducing or preventing these reductions of the groundwater head. Drawdown, as a result of groundwater extraction, among other things, influences seepage or infiltration and settlement of semipervious layers, resulting in subsidence and an increase of the hydraulic resistance. The influence of another activity on the hydrological regime, the cutting of a canal, can make a considerable call on a groundwater reservoir. In view of the increasingly strong confrontation with other interests, intensive investigation is required into the most suitable locations for groundwater extraction. Extracted groundwater which is not consumed must be returned to the soil if possible. In addition to this, continuous attention should be given to other possibilities to satisfy the need of water. (See also W78-08065 and W79-07426 thru W79-07488) (Humphreys-ISWS)
W80-00978

NUMERICAL SIMULATION OF MATERIAL TRANSPORT IN A REGIONAL GROUNDWATER FLOW SYSTEM,
California Univ., Livermore. Lawrence Livermore Lab.
T. D. Naymik, and L. D. Thorson.
Report UCRL-52556, 1978. 23 p, 9 Fig, 5 Tab, 11 Ref.

Descriptors: *Model studies, *Groundwater, *Numerical analysis, *Mass transfer, *Flow system, Regional analysis, Porosity, Distribution, Hydraulic properties, Groundwater movement, Equations, Material transport.

A numerical model of a regional groundwater flow system (not site specific) was coupled with a material transport model in order to study the influence of porosity and distribution coefficients in bedded media. The effects on model performance were discerned from long-term material transport simulations. Model performance was based on initial breakthrough time, average breakthrough time, and the standard deviation of the breakthrough curve at a discharge surface. Large differences in model performance occurred when the distribution coefficient was changed less than an order of magnitude, while small differences resulted from changing porosity several orders of magnitude. (Visocky-ISWS)
W80-01042

METHOD AND APPARATUS FOR UTILIZING ACCUMULATED UNDERGROUND WATER IN THE MINING OF SUBTERRANEAN SULPHUR,
Freeport Minerals Co., New York. (Assignee).
R. L. Williams, R. L. Latiolais, J. L. Gabriel, and R. L. Bouis.
U.S. Patent No 4,157,847, 13 p, 5 Fig, 16 Ref; Official Gazette of the United States Patent Office, Vol 983, No 2, p 325, June 12, 1979.

Descriptors: *Patents, *Mining, *Mine water, *Water reuse, Recycling, Pollution abatement, Sulfur, Water pollution sources, Hot water, Sulfur mining, Energy conservation.

It is the purpose of this invention to recover and re-use the heat of the hot underground water accumulated from ongoing and/or previous sulphur mining operations without bringing the water to the surface. The invention is especially applicable to the Frasch mining process where hot water having a temperature sufficiently high to liquefy sulphur is pumped underground to contact the subterranean sulphur-bearing ore to heat it and ultimately convert the solid sulphur contained by the ore to liquid sulphur which is then brought to the surface. In heating the sulphur-bearing ore, some of the heat of the hot water is spent and the water is somewhat reduced in temperature but remains hot and accumulates in large quantities underground. The spent hot water remains hot underground because of the insulating nature of the formation which surrounds it. Because of its lower specific gravity compared to liquid sulphur and cooler connate waters the spent hot water rises in the formation, e.g., in the leached or barren zones of the caprock, and accumulates in the upper regions. The invention comprises a method of and apparatus for subterraneanly recycling the accumulated hot water to the lower, sulphur-enriched, productive zones of the formation where it contacts and contributes heat to solid sulphur. (Sinha-OEIS)
W80-01180

2G. Water In Soils

AN INITIAL VALUE PROBLEM FOR THE HORIZONTAL INFILTRATION OF WATER,
Princeton Univ., NJ. Dept. of Civil Engineering.
D. K. Babu, and M. Th. Van Genuchten.
Water Resources Research, Vol 15, No 4, p 867-872, August 1979. 2 Fig, 22 Ref.

Descriptors: *Infiltration, *Soil water movement, *Mathematical models, Diffusivity, Equations, Moisture content, Finite element analysis, Mathematical studies, Model studies, Perturbation analysis, Soil columns.

An initial value problem for the horizontal infiltration of water was solved by means of a perturbation technique. The diffusivity was assumed to vary as a positive power of the normalized water content. Evolution of the profile was supposed to be taking place in two stages. In the first stage, moisture content at the origin increases steadily as some arbitrary power of dimensionless time until the maximum normalized value of unity is attained; thereafter, in the second stage, moisture content at the origin remains at the constant value of unity. The moisture distribution at the end of the first stage defines the initial values of moisture for the problem in the second stage. This paper derived the flow details for the second stage and constructed moisture profiles as they evolve for times greater than unity. (Visocky-ISWS)
W80-00950

PERSPECTIVE ON 'DELAYED YIELD',
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2F.
W80-00952

SOIL WATER HYSTERESIS AS A CAUSE OF DELAYED YIELD FROM UNCONFINED AQUIFERS,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 2F.
W80-00959

UNSATURATED WATER FLOW WITHIN POROUS MATERIALS OBSERVED BY NMR IMAGING,
University of Manchester Inst. of Science and Technology (England).
R. J. Gummerson, C. Hall, W. D. Hoff, R. Hawkes, and G. N. Holland.
Nature, Vol 281, No 5725, p 56-57, August 30, 1979. 4 Fig, 14 Ref.

Descriptors: *Porous media, *Unsaturated flow, *Nuclear magnetic resonance, *Laboratory tests, Wetting, Drying, Moisture content, Diffusivity, Capillary action, Capillary conductivity, Capillary water, Absorption, Analytical techniques, Soil water, Soil science.

Wetting, drying, and permeation processes in various porous materials are of special interest to soil science, agriculture, building science, and chemical engineering. Direct experimental study of unsaturated flow within such materials is hampered by the difficulty of detecting with precision changes in their internal water content distributions. In laboratory work on soils, gravimetric sampling is widely used. However, this is a destructive method which interferes with water flow processes and in any case is not easy to apply accurately to rigid materials such as permeable rocks, ceramics, and building materials. Gamma-ray attenuation is the only established non-destructive instrumental method in laboratory use. This paper reported the first use of a nuclear magnetic resonance (NMR) imaging technique to monitor the dynamics of the internal water content distribution in several porous inorganic materials during capillary inflow. (Sims-ISWS)
W80-00963

ERRORS IN DETERMINATION OF THE WATER CONTENT OF A TRICKLE IRRIGATED SOIL VOLUME,
Ben-Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Desert Research.
J. Ben-Asher.
Soil Science Society of America Journal, Vol 43, No 4, p 665-668, July-August 1979. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Soil water, *Arizona, *Moisture content, *Irrigation, On-site data collections, Sampling, Data processing, Statistics, Gravimetry, Bulk density, Soil water movement, *Yuma(AZ), *Israel, *Nahal Sinai(Israel), Error analysis.

A short review of the possible methods of measuring soil water content under high frequency trickle irrigation suggested that the gravimetric method was most appropriate. Three sources of errors in this method were evaluated and discussed. The sources were those of water content by weight, bulk density, and integration based on the sampling grid. Furthermore, as the sampling mesh became larger than the defined standard deviation (SD). Error analysis of measurements on uniform Bet Dagan grumusol and sandy soils of Nahal Sinai (Israel) and Yuma (Arizona) showed that coefficient of variation in volume of water within an irrigated volume element may be reduced if the sampling grid is taken properly. The analysis suggested that for a given coefficient of variation and interval of sampling depth, an optimum distance between lateral samples can be evaluated from a mathematical reorganization of the coefficient of variation. (Sims-ISWS)
W80-00979

LINEARIZED MOISTURE FLOW FROM LINE SOURCES WITH WATER EXTRACTION,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
A. W. Warrick, A. Amoozegar-Fard, and D. O. Lomen.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 3, p 549-553 and 559, May-June 1979. 4 Fig, 14 Ref.

Descriptors: *Soil water, *Soil water movement, *Flow, *Irrigation, Model studies, Mathematical models, Theoretical analysis, Soils, Soil-water-plant relationships, Hydraulic conductivity, Moisture uptake, Moisture content, Vegetation, Vegetation effects, Evaporation, Agriculture, Line sources.

The linearized moisture flow equation was solved for two-dimensional line sources (buried or on the surface) with water extraction. Linearization was attained in the steady-state case by assuming the unsaturated hydraulic conductivity, K, was exponentially related to the pressure head, h, as K = K sub o exp (alpha h). The water extraction was one-dimensional, while the surface loss was proportional to exp (alpha h). As an aid for design or oper-

ation, an algebraic relationship was presented giving the value of pressure head midway between lines for surface sources under steady conditions, with or without plant uptake. This form allowed straightforward determination of pressure head using a calculator. As a further aid, nomographs relate pressure head midway between sources to rooting depth, source strength, and uptake amount. The nomographs can be used directly without following through the theoretical developments. Distribution patterns of h for surface and subsurface sources were also given. (Sims-ISWS)
W80-00980

2H. Lakes

GAZETTEER OF COAL-MINE LAKES IN SOUTHWESTERN INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
L. L. Bobo.
Geological Survey Water-Resources Investigations 79-67 (open-file report), June 1979. 107 p, 54 Fig, 2 Tab, 13 Ref.

Descriptors: *Lakes, *Strip mines, *Coal mines, *Artificial lakes, *Indiana, Water quality, Hydrogen ion concentration, Specific conductivity, Color, Lake morphometry, *Gazetteer of coal-mine lakes, *Southwest Indiana.

This gazetteer is a catalog of lakes formed by surface coal mining in southwestern Indiana that are 0.5 acre or larger and in nonactive mine areas. Approximately 1,000 of the lakes are listed by 7.5-minute quadrangle topographic-map name, lake-identification number, latitude and longitude, and county. Other data given are shape of lake, maximum length, mean width, length and development of shoreline, surface area, orientation, presence of a stream inlet or outlet, and geologic data (geologic formation of area surrounding the lake and the mined coal-bed member). Field data (sampling date, pH, specific conductance, apparent color of lake, and general vegetation along the shoreline) were collected for 287 of the lakes. The apparent colors of the lakes observed were varying shades of aqua, blue, brown, lime green, red, and green. Eighty percent of the lakes sampled were green. (Woodard - USGS)
W80-00921

ANALYSIS OF WATER-LEVEL FLUCTUATIONS OF LAKES WINONA AND WINNEMISSETT--TWO LANDLOCKED LAKES IN A KARST TERRANE IN VOLUSIA COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. H. Hughes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 860, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-55, 1979. 24 p, 16 Fig, 5 Ref.

Descriptors: *Lakes, *Water level fluctuations, *Rainfall disposition,*Surface-groundwater relationships, *Karst hydrology, Artesian aquifers, Water table aquifers, Lake basins, Storm runoff, Inflow, *Lake Winona(FL), *Lake Winnemissett(FL), *Volusia County(FL).

The water levels of Lakes Winona and Winnemissett in Volusia County, Fla., correlate reasonably well during dry spells but only poorly during wet spells. Disparities develop mostly at times when the lake levels rise abruptly owing to rainstorms passing over the lake basins. The lack of correlation is attributed to the uneven distribution of the storm rainfall, even though the average annual rainfall at National Weather Service gages in the general area of the lakes is about the same. Analyses of the monthly rainfall data show that the rainfall variability between gages is sufficient to account for most of the disparity between monthly changes in the levels of the two lakes. The total annual rainfall at times may differ between rainfall gages by as much as 15 to 20 inches. Such differences tend to balance over the long term but may persist in the same direction for two or more years, causing apparent anomalies in lake-level fluctuations. (Woodard-USGS)
W80-00925

CONVECTIVE AND ADVECTIVE CIRCULATION OF LAKE POWELL, UTAH-ARIZONA, DURING 1972-1975,
Dartmouth Coll., Hanover, NH. Dept. of Earth Sciences.
N. M. Johnson, and D. H. Merritt.
Water Resources Research, Vol 15, No 4, p 873-884, August 1979. 13 Fig, 14 Ref, 1 Append.

Descriptors: *Water circulation, *Utah, *Arizona, *Colorado river, Hydrology, Lakes, Convection, Advection, Dissolved solids, Lake morphology, Water chemistry, Water temperature, *Lake circulation, *Lake Powell(AZ), *Glen Canyon Dam(AZ), Convective circulation, Advective circulation, Lake stratification, Total dissolved solids.

The water circulation in Lake Powell has been documented and analyzed for the period 1972-1975 on a monthly, synoptic basis. From its inception, Lake Powell has convectively mixed only during the winter cooling period. However, at no time during 1972-1975 did this vertical mixing extend to the lake bottom. During the winter, dissolved salt becomes important in stabilizing the lake. The yearly heat budget of the lake averages 40kcal/sq cm. A dominant feature of the summer circulation of the lake is an overflow density current from the upstream Colorado River. The overflow current mechanically sets the depth and extent of the thermocline. During maximum stratification (July-September), a pervasive and intense oxygen-depletion layer develops immediately below the epilimnion-thermocline interface. Cold, dense upstream waters intrude the lake during the winter as an underflow density current, which annually replenishes the oxygen supply of the bottom waters. An integral component of the lake's circulation throughout the year is a withdrawal current at mid-depth within the lake. The configuration and extent of the withdrawal current are a function of dam operation and seasonal density stratification. (Lee-ISWS)
W80-00951

THE LIMNOLOGICAL RESPONSE OF A WEST VIRGINIA MULTIPURPOSE IMPOUNDMENT TO ACID INFLOWS,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 5B.
W80-00954

MEASUREMENTS IN INTERSECTING SUBMERGED AND INDUCED JETS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
W. H. C. Maxwell, and A. Snorrason.
Report UILU-ENG-79-2011, 1979. 37 p, 7 Fig, 1 Tab, 17 Ref.

Descriptors: *Jets, *Laboratory tests, *Model studies, *Flow, Hydraulics, Measurement, Laboratory equipment, Velocity, Analysis, Analytical techniques, Mathematical models, Hydraulic models, Mixing, Submerged jets, Water jets, Air jets.

Simple analytic models were developed using the momentum principle to predict the axis of the resultant flow when (1) two jets of the same fluid cross, and (2) a horizontal water jet is crossed by a vertical jet induced by an air bubble source. Data were collected for two crossing air jets and two crossing water jets. This, together with data from another source, gave excellent agreement with the analytic model. Data over a limited range of relative water discharges were collected for the water bubble screen flow and showed good agreement with the analysis in that range. The range of relative discharges of air and water needs to be extended. It would also be of interest to conduct experiments in which the relative locations of the air source and water jet are varied. There is a need for further work to determine how to predict the combined flow field in its entirety rather than to focus only on the axis of maximum velocity and to extend the results to practical applications such as cooling water discharges into cross-currents in streams or reservoirs. (Humphreys-ISWS)
W80-00977

SEDIMENT OXYGEN DEMAND IN A SHALLOW OXBOW LAKE,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 5A.
W80-01010

MICROBIAL TRANSFORMATIONS OF SULFUR COMPOUNDS IN A STRATIFIED LAKE (SOLAR LAKE, SINAI),
Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.
B. B. Jorgensen, J. G. Kuenen, and Y. Cohen.
Limnology and Oceanography, Vol 24, No 5, p 799-822, September 1979. 13 Fig, 5 Tab, 48 Ref.

Descriptors: *Lakes, *Sulfur compounds, *Aquatic microbiology, Stratification, Chemicals, Temperature, Water temperature, Oxygen, Carbon dioxide, Hydrogen sulfide, Sulfates, Sulfides, Salinity, Chemical stratification, Bacteria, Microbiology, Sampling, Chemical analysis, Limnology, *Solar lake(Sinai).

Microbiological and chemical aspects of the sulfur cycle were studied in the chemocline of a tropical salt lake. Oxygen and sulfide coexisted in a 0-10-cm layer which migrated up and down during a diurnal cycle. Sulfide was rapidly oxidized by oxygen, with a half-life of 5-10 min, to produce mainly sulfate and thiosulfate. Thiosulfate and elemental sulfur had concentration maxima in the chemocline, while polysulfide was abundant throughout the sulfide zone. Radiotracer experiments showed that the elemental sulfur was produced by anoxygenic photosynthesis in cyanobacteria. The elemental sulfur was further oxidized or again reduced, depending on the presence or absence of oxygen. Cyanobacteria in the chemocline shifted between anoxygenic photosynthesis in the morning and oxygenic photosynthesis in the afternoon. A high dark CO2 fixation was found in the chemocline which could be stimulated by sulfide, elemental sulfur, and thiosulfate. The oxidation rate of sulfide in the chemocline was dependent on the presence of bacteria. (Sims-ISWS)
W80-01024

AN IMPROVED AERODYNAMIC EVAPORATION TECHNIQUE FOR LARGE LAKES WITH APPLICATION TO THE INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2D.
W80-01029

TRANSVERSE UPWELLING IN A LONG NARROW LAKE, WITH APPLICATIONS TO BABINE LAKE AND LAKE MICHIGAN,
College of New Caledonia, Prince George (British Columbia).
C. A. Lee, and L. A. Mysak.
Atmosphere-Ocean, Vol 17, No 3, p 200-218, 1979. 12 Fig, 1 Tab, 19 Ref, 1 Append.

Descriptors: *Upwelling, *Lakes, *Winds, *Lake Michigan, *Model studies, Mathematical models, Theoretical analysis, Thermocline, Circulation, Water circulation, Stress, Wind pressure, Limnology, *Babine Lake(British Columbia), Narrow lakes.

The wind generation of transverse thermocline motions in an infinitely long two-layer channel was studied theoretically. Winds both along and across the channel were considered. Horizontal momentum transfer was parameterized by a constant coefficient of eddy viscosity. For a channel narrow compared with its internal Rossby radius of deformation, the transverse motions are uni-modal and are generated most efficiently by long-shore winds. Theoretical results in this narrow channel limit agreed well with observations made at Babine Lake, British Columbia. For a channel wide com-

pared with its Rossby radius, the response is multimodal, especially for cross-channel winds. For a model Lake Michigan, computed interfacial displacements due to a steady wind either across or along the channel are small compared with the observed displacements. However, a semi-diurnal wind (in either direction) is in near resonance with the seventh transverse mode. Thus, multi-modal displacements as large as those observed could possibly be generated by semi-diurnal winds across or along the channel. (Sims-ISWS)
W80-01030

SURVEY OF SOME CANADIAN LAKES FOR THE PRESENCE OF ULTRASTRUCTURALLY DISCRETE PARTICLES IN THE COLLOIDAL SIZE RANGE,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W80-01037

THE DEAD SEA: DEEPENING OF THE MIXOLIMNION SIGNIFIES THE OVERTURE TO OVERTURN OF THE WATER COLUMN,
Weizmann Inst. of Science, Rehovot (Israel).
I. Steinhorn, G. Assaf, J. R. Gat, A. Nishry, and A. Nissenbaum.
Science, Vol 206, No 4414, p 55-57, October 5, 1979. 2 Fig, 8 Ref.

Descriptors: *Lakes, *Saline lakes, *Salinity, Mixolimnion, Meromixis, Turnovers, Stratification, Salts, Saline water, Temperature, Water temperature, Chemicals, Manganese, Iron, Helium, Surveys, On-site investigations, Limnology, *Dead Sea(Israel).

Throttling of freshwater inputs into the meromictic Dead Sea weakened the longterm stability of the water column. Between 1975 and 1978, successive deepenings of the pycnocline from 70 meters to beyond 200 meters were recorded. Complete overturn finally took place during the winter of 1978-1979. This unique process was accompanied by changes in the geochemistry of several components. (Sims-ISWS)
W80-01039

2J. Erosion and Sedimentation

EFFECT ON SEDIMENT YIELD AND WATER QUALITY OF A NONREHABILITATED SURFACE MINE IN NORTH-CENTRAL WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div., and Geological Survey, Lakewood, CO. Water Resources Div.
B. H. Ringen, L. M. Shown, R. F. Hadley, and T. K. Hinkley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 868, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-47, 1979. 23 p, 9 Fig, 7 Tab, 5 Ref.

Descriptors: *Coal mines, *Strip mine wastes, *Sediment yield, *Water quality, *Wyoming, Erosion, Water pollution, Surface waters, Groundwaters, Topography, Vegetation, Sediment distribution, Sedimentation rates, Ponds, *North-central Wyoming, *Unrehabilitated strip-mining area.

Sediment and chemical quality of water data were collected from two adjacent drainage basins in northern Wyoming to compare hydrologic differences between an undisturbed basin and a surface-mined, virtually unrehabilitated basin. Rate of sediment accumulation in a pond in the basin that was surface mined for coal and left unrehabilitated was over 11 times greater than in a pond in the adjacent unmined basin. The additional sediment came primarily from barren high walls and roughly graded spoils. No sediment was yielded from ungraded spoil rows that drained to closed depressions. Most sediment yielded from the two basins was trapped in the two ponds. The chemical composition of materials from slopes, channels, and pond bottoms of the two basins were similar; however, concentrations of dissolved and suspended matter in waters of the two ponds were different. Low concentrations of dissolved chemical constituents in the pond water below the unmined basin suggest surface runoff as the source. Higher concentrations of dissolved chemical constituents, notably calcium, magnesium, and sulfate, in pond water below the mined area suggest ground-water discharge as the source. Sediment yield was a better indicator of the effects of disturbance on mined areas than chemical quality of water. (Woodard-USGS)
W80-00928

CHEMICAL AND PHYSICAL PROCESSES CONTROLLING THE CHEMICAL COMPOSITION OF SUSPENDED MATERIAL IN THE RIVER TAY ESTUARY,
Edinburgh Univ. (Scotland). Grant Inst., of Geology.
For primary bibliographic entry see Field 2L.
W80-00960

SUSPENDED SEDIMENT SOURCES IDENTIFIED BY MAGNETIC MEASUREMENTS,
Exeter Univ. (England). Dept. of Geography.
D. E. Walling, M. R. Peart, F. Oldfield, and R. Thompson.
Nature, Vol 281, No 5727, p 110-113, September 13, 1979. 4 Fig, 1 Tab, 11 Ref.

Descriptors: *Sediments, *Suspended solids, *Sediment transport, *Laboratory tests, Sampling, Magnetic studies, Runoff, Erosion, Soil erosion, Water pollution, Water pollution sources, Pollutant identification, Sedimentology, Magnetic measurements, Suspended sediment sources.

A procedure for identifying the main source of the suspended sediment load of a stream by simple, cheap, rapid, and nondestructive magnetic measurements is applicable to samples taken during the routine sampling of flood events, permitting general characterization of the load and more detailed investigation of variations in sediment source both during and between individual flood events. (Sims-ISWS)
W80-00964

PRELIMINARY IDENTIFICATION OF PRICE RIVER BASIN SALT PICK-UP AND TRANSPORT PROCESSES,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
J. P. Riley, D. S. Bowles, D. G. Chadwick, and W. J. Grenney.
Water Resources Bulletin, Vol 15, No 4, p 984-995, August 1979. 4 Fig, 21 Ref.

Descriptors: *Rivers, *Colorado River, *Salinity, *Sediment transport, *Utah, Model studies, Mathematical models, Watersheds(Basins), Salts, Sediments, Erosion, Channel erosion, Flow, Streamflow, Hydrology, *Price River(UT).

The Price River is a significant contributor of salt to the Colorado River. Relatively pristine waters leaving the upper elevations of the basin degenerate into highly saline waters entering the Green River. This paper presented the structure of an evolving model of the salt pick-up and transport processes in the Price River basin. The initial purpose of the model was to aid in the identification of the natural and man-modified hydro-salinity-sediment system of the basin, based on data collection and analysis in the field and the laboratory. This identification procedure will result in both a better qualitative understanding of the important physiochemical processes and a mathematical description of these processes. When the identification stage is complete, the model will be used as a management tool for such purposes as examining various strategies for reducing salt loads in the Price River and in other similar rivers. (Sims-ISWS)
W80-00981

SEDIMENTATION AND THE DISTRIBUTION OF ORGANIC MATTER IN A SUB-ANTARCTIC MARINE BAY,
British Museum of Natural History, London.
H. M. Platt.
Estuarine and Coastal Marine Science, Vol 9, No 1, p 51-63, July 1979. 6 Fig, 4 Tab, 28 Ref.

Descriptors: *Sedimentation, *Organic matter, *Bays, *Antarctic, *Antarctic Ocean, Sediments, Cores, Sampling, Coasts, Salinity, Water temperature, Winds, Runoff, Rainfall, Sediment transport, Spatial distribution, Estuaries, Sediment traps

The annual rate of sediment accumulation and the proportion due to resuspension in a sheltered sub-Antarctic bay were deduced from sediment trap experiments and vertical profiles of organic matter in the sea bed. A dry weight sediment accumulation of 2800 G/sq m/year was suggested with an organic input of 60 g carbon/sq m/year. Seasonal variations in sedimentation were associated with winds and land runoff. Residual organic matter in deep sediment profiles reflects the recent history of pollution in the area and provides a means of dating the sediments. (Sims-ISWS)
W80-01015

A MODEL FOR THE ESTIMATION OF THE CONCENTRATIONS AND SPATIAL EXTENT OF SUSPENDED SEDIMENT PLUMES,
State Univ. of New York, Stony Brook. Marine Sciences Research Center
R. E. Wilson
Estuarine and Coastal Marine Science, Vol 9, No 1, p 65-78, July 1979. 8 Fig, 5 Ref.

Descriptors: *Sediments, *Suspended solids, *Spatial distribution, *Dredging, *Gulf of Mexico, Diffusion, Model studies, Mathematical models, Oceans, Coasts, Settling velocity, On-site data collections, Spoil banks, Sedimentation, Plumes(Aquatic), Diffusion-advection models.

A simple model was presented for the spatial structure of suspended sediment plumes produced by overboard pipeline disposal of dredge spoil in shallow waters. The model was based on a solution to the advection-diffusion equation for a continuous vertical line source. It provided information on the variation of both centerline concentration and the second moment of the lateral distribution with distance from the source. The structure of the plume was described by only two parameters: one proportional to the settling velocity of the suspended material, and the other equal to the ratio of a diffusion velocity to the advective velocity of the ambient flow. The model was applied to represent the structure of observed suspended sediment plumes at three separate shallow water sites. (Sims-ISWS)
W80-01016

ESTIMATING AVERAGE VELOCITY IN GRAVEL-BED RIVERS,
New Brunswick Univ., Fredericton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01023

SEDIMENTATION PROCESSES IN A SHORT RESIDENCE-TIME INTERMONTANE LAKE, KAMLOOPS LAKE, BRITISH COLUMBIA,
National Water Research Inst., Vancouver (British Columbia)
C. H. Pharo, and E. C. Carmack.
Sedimentology, Vol 26, No 4, p 523-541, August 1979. 13 Fig, 1 Tab, 27 Ref.

Descriptors: *Sedimentation, *Lakes, *Canada, *Deltas, On-site investigations, Rivers, Analysis, Analytical techniques, Sedimentation rates, Suspended load, Sediment transport, Sediments, On-site data collections, Turbidity, Deposition(Sediments), Turbidity currents, Density currents, Geomorphology, Water temperature, *British Columbia, *Kamloops Lake(British Columbia), *Thompson River(British Columbia).

Kamloops Lake in central British Columbia is a deep, intermontane lake fed by the strong and seasonally variable flows of the Thompson River. Briefly, the lake is typical of fiord-type intermon-

tane lakes; it is long (25 km), narrow (2.1 km), deep (maximum depth, 145 m), and situated in a relict glacial valley. The flow of the Thompson River, the dominant river entering Kamloops Lake, shows high seasonal variability (range, 100-3000 cu m/s; annual mean, 700 cu m/s). As a consequence, lake level varies annually by up to 7 m, while the bulk residence time for lake water (defined as T = V/R, where V is lake volume and R is streamflow) varies from approximately 1 year in late winter to less than 20 days during spring freshet. Considerations of lake-river interaction, supported by physical and geological evidence, suggest that sediment transport and deposition within the lake is controlled by three interdependent but distinct processes: delta progradation at the lake-river confluence which results in delta topset and foreset bedding; sediment density surges originating along the delta face which result in turbidite sequences lakeward from the base of the delta; and dispersal by the interflowing river plume which, due to Coriolis effects, results in a higher sedimentation rate and greater fraction of coarser material along the right-hand side (Northern Hemisphere) of the lake in the direction of flow. (Humphreys-ISWS)
W80-01034

UNDULAR HYDRAULIC JUMPS AND THE FORMATION OF BACKLASH RIPPLES ON BEACHES,
Oregon State Univ., Corvallis. School of Oceanography.
For primary bibliographic entry see Field 2L.
W80-01035

PROCEEDINGS OF A WORKSHOP ON COASTAL ZONE RESEARCH IN MASSACHUSETTS (NOVEMBER 27-28, 1978),
Woods Hole Oceanographic Institution, MA.
D. G. Aubrey.
Woods Hole Oceanographic Institution Technical Report WHOI-79-40, April 1979. 118 p, 3 Append.

Descriptors: *Coasts, *Estuaries, *Beaches, *Oceanography, Geology, Sediment transport, Sedimentation, Massachusetts, Coastal zone, Beach profiles, Sea Grant program.

A Workshop on Coastal Zone Research held on 27 and 28 November, 1978, at Woods Hole Oceanographic Institution, brought together fifty researchers actively studying physical processes in the Massachusetts coastal zone. Although the scope of the workshop was narrow, emphasizing only selected aspects of coastal zone research, it represented an important attempt to assess knowledge of physical processes in the nearshore, and to encourage cooperation and communication between scientists. Two sets of recommendations evolved from the workshop. The first set recommends ways to facilitate scientist - user communication, and provide more rapid dissemination of coastal research results. The second set describes areas of future research in the Massachusetts coastal zone. (NOAA)
W80-01136

EFFECTS OF AN OIL SPILL ON SALT MARSHES AT HARBOR ISLAND, TEXAS. I: BIOLOGY.
S. Holt, S. Rabalais, N. Rabalais, S. Cornelius, and J. S. Holland.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 345-352, 1 Fig, 2 Tab, 7 Ref.

Descriptors: *Oil spills, *Salt marshes, *Environmental effects, *Water pollution effects, Surveys, Resources development, Texas, Pipelines, *Outer continental shelf, Spartina alterniflora, Avicennia germinans, Monitoring.

On October 13, 1976, an American Petrofina Company pipeline ruptured, dumping about 377 barrels of crude oil into the cordgrass (Spartina alterniflora and black mangrove (Avicennia germinans) marshes at Harbor Island in Redfish Bay near Port Aransas, Texas. A biological and chemical survey was begun the day following the spill. A single study site (4 stations ranging from above mean high tide to below mean low tide) was selected to monitor the benthos. Surveys of marsh vegetation were made on periodic trips to the area. Various types of clean-up procedures (Including no cleanup of some areas) and different concentrations of oil coverage were monitored. (Sinha - OEIS)
W80-01149

BIOLOGICAL MONITORING OF SEDIMENTS IN EKOFISK OILFIELD,
Field Studies Council, Pembroke (England). Oil Pollution Research Unit.
For primary bibliographic entry see Field 5C.
W80-01156

THE INFAUNAL BENTHOS OF PETROLEUM-CONTAMINATED SEDIMENTS: STUDY OF A COMMUNITY AT A NATURAL OIL SEEP,
California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 5C.
W80-01158

POTENTIAL LONG-TERM EFFECTS OF PRUDHOE BAY CRUDE OIL IN ARCTIC SEDIMENTS ON INDIGENOUS BENTHIC INVERTEBRATE COMMUNITIES,
Louisville Univ., KY. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-01160

2K. Chemical Processes

GEOHYDROLOGY OF BROOKS, LOWNDES, AND WESTERN ECHOLS COUNTIES, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-00941

ATMOSPHERIC CONTRIBUTIONS TO STREAM WATER CHEMISTRY IN THE NORTH CASCADE RANGE, WASHINGTON,
Washington Univ., Seattle. Dept. of Geological Sciences.
D. P. Dethier.
Water Resources Research, Vol 15, No 4, p 787-794, August 1979. 4 Fig, 9 Tab, 52 Ref.

Descriptors: *Chemistry of precipitation, *Water pollution sources, *Precipitation(Atmospheric), *Washington, Streams, Lakes, Surface waters, Runoff, Mountains, Water pollution, Pollutants, Path of pollutants, Chemicals, Sampling, Data processing, Chemistry, *Cascade range(WA).

Bulk precipitation contributes significant quantities of cations and trace metals to a subalpine catchment located in the North Cascade Range of Washington. Precipitation loadings account for 30% of the major and more than 50% of the minor element export from the catchment. Preliminary data from larger basins in the North Cascades suggested similar values. Calcium and potassium measured in bulk precipitation are largely derived from continental dusts, while sodium and magnesium originate as marine aerosols. Lead, copper, and arsenic, products of anthropogenic activity in the Puget Lowland, are deposited downwind in the Cascade Mountains; mean precipitation pH at the study site was 4.85 during 1974 and 1975. Elements contributed by precipitation become part of complex upland biogeochemical cycles. With the exception of highly mobile ions like sodium, elemental levels in streamflow reflect biologic and pedogenic cycling processes rather than direct precipitation influence. (Sims-ISWS)
W80-00948

MICROBIAL TRANSFORMATIONS OF SULFUR COMPOUNDS IN A STRATIFIED LAKE (SOLAR LAKE, SINAI),
Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.
For primary bibliographic entry see Field 2H.
W80-01024

NIAGARA RIVER CHEMICAL LOADING 1975-1977,
Canada Centre for Inland Water, Burlington (Ontario).
C. H. Chan.
Scientific Series No 106, 1979. 11 p, 19 Fig, 8 Tab, 9 Ref.

Descriptors: *Water sampling, *Chemical analysis, *Data collections, Hydrogen ion concentration, Phosphorus, Nitrogen, Sodium, Calcium, Lake Erie, Sampling, Average flow, *Niagara River, Niagara-on-the-Lake, Chemical loading.

Detailed analyses of chemical data collected daily over a 29-month period from August 1975 to December 1977 at Niagara-on-the-Lake have identified short-term trends in some of the water quality parameters. The pH, phosphorus and nitrogen concentrations remained relatively stable. Seasonal variation in major ions concentrations was observed to occur inversely to the outflow of the Niagara River. Due to a 9 percent decline in water supply to Lake Erie during 1977, there was a significant decrease in calcium, magnesium and sulphate concentrations, but sodium and chloride concentrations were higher. The annual phosphorus load for 1977 was 11.78 metric tons per day compared with 13.53 metric tons per day in 1976, a 13 percent decrease. Results computed from different sampling frequencies suggested that a sampling frequency of once per week for phosphorus would yield results to within 5 percent of daily sampling. (WATDOC)
W80-01172

2L. Estuaries

APPLICATION OF TRANSIENT-FLOW MODEL TO THE SACRAMENTO RIVER AT SACRAMENTO, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. N. Oltmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 103, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-119, February 1979. 23 p, 6 Fig, 2 Tab, 4 Ref.

Descriptors: *Unsteady flow, *Tidal streams, *Model studies, *Streamflow, *Tidal effects, Computer models, Simulation analysis, Methodology, Open channel flow, Flow rates, Stream gages, *Sacramento River(CA), *Sacramento-Freeport tidal reach.

The transient-flow simulation model was applied to the Sacramento River at Sacramento, Calif. An alternative is needed to the empirical stage-fall-discharge computational method, which provides only daily mean discharges and requires frequent measurement over a 25- to 26-hour period of the tide-affected flow. Measurement of tide-affected flow involves use of a cable suspended across the river; this presents a hazardous navigational condition. Use of the model does not eliminate the hazardous navigational problem, but it significantly reduces the time that this condition exists. The model has demonstrated that it can provide reliable daily mean as well as instantaneous discharge data. The model also has the capability of providing discharge data for locations farther downstream in the tidal zone from the Sacramento stream gage; this is not possible with the stage-fall-discharge computational method. (Woodard-USGS)
W80-00940

CHEMICAL AND PHYSICAL PROCESSES CONTROLLING THE CHEMICAL COMPOSITION OF SUSPENDED MATERIAL IN THE RIVER TAY ESTUARY,
Edinburgh Univ. (Scotland). Grant Inst., of Geology.
E. R. Sholkovitz.

Estuarine and Coastal Marine Science, Vol 8, No 6, p 523-545, June 1979. 15 Fig, 4 Tab, 48 Ref.

Descriptors: *Suspended solids, *Sediments, *Chemicals, *Estuaries, On-site investigations, Laboratory tests, Sampling, Rivers, Coasts, Salinity, Tides, Mixing, Chemical analysis, Sedimentology, Hydrology, *British coast, *River Tay Estuary(England).

The chemical composition (Al, Si, Ti, K, Ca, Mg, P, Org.C, Fe and Mn) of suspended material in the Tay Estuary and River Tay was measured to determine the relation between river and estuary material and chemical reactions which may be occurring during estuarine mixing. Variations in the ratios of Fe/Al, Mn/Al, Ti/Al, etc., with salinity and suspended load during a tidal station suggest that sedimentological and hydrological processes, rather than chemical ones, are responsible for the observed compositional changes. This interpretation was confirmed by laboratory mixing experiments which also contradicted published reports of Fe and Mn desorption in estuaries. Measurements of suspended matter composition will not easily determine whether desorption or adsorption of element occurs when river-borne suspended material enters the saline environment. A tentative conclusion on the River Tay study was that the suspended matter in the Tay Estuary results from the input of material at times of high suspended loads and of high river water discharge. (Sims-ISWS)
W80-00960

VARIATIONS OF LONGITUDINAL DIFFUSIVITY IN THE HUDSON ESTUARY,
City Coll. of New York. Inst. of Marine and Atmospheric Sciences.
E. S. Posmentier, and J. M. Raymont.
Estuarine and Coastal Marine Science, Vol 8, No 6, p 555-564, June 1979. 4 Fig, 2 Tab, 9 Ref.

Descriptors: *Estuaries, *Diffusivity, *Salinity, *Hudson River, Model studies, Mathematical models, On-site investigations, Tidal waters, Tides, Data collections, Data processing, Salts, Saline water-freshwater interfaces, Mixing, Coasts, Circulation, Water circulation, *Hudson Estuary(NY).

The coefficient of longitudinal diffusion for salt was calculated from the distribution of salinity observed in the Hudson Estuary at 9 different times during 1974. The salinity distribution appears to be quasi steady-state, and the diffusion coefficient is spatially constant between the Upper Bay and Verplanck. The diffusion coefficient varied in time by a factor of 3. It was not well correlated with the stratification parameter. It was slightly less dependent on the freshwater discharge in the Estuary than on the tidal amplitude, which varies by a factor of nearly 2 between spring and neap tides. Salinities predicted by a model are slightly less accurate if the diffusion coefficient depends on the stratification parameter than if the diffusion coefficient is kept constant. If the diffusion coefficient is a power function of both freshwater discharge and tidal amplitude, salinity predictions are significantly improved. These results suggest that density-induced, gravitational, vertical circulation does not dominate the longitudinal diffusion of salt in the Hudson Estuary. Transverse circulation may be at least as significant a salt transport mechanism as vertical circulation. The predictive reliability of a one-dimensional, advective-diffusive model of the salinity distribution in the Hudson Estuary depends on a realistic, variable coefficient of longitudinal diffusion for salt. Furthermore, such a model cannot use the same coefficient to predict the distribution of other properties unless the combination of transport mechanism for these other properties is the same as that for salt. (Sims-ISWS)
W80-00961

RESONANT OVER-TIDE ACROSS AND ALONG TASMAN BAY, NEW ZEALAND,
Department of Scientific and Industrial Research, Wellington (New Zealand). Oceanographic Inst.
R. A. Heath.
Estuarine and Coastal Marine Science, Vol 8, No 6, p 583-595, June 1979. 8 Fig, 2 Tab, 16 Ref.

Descriptors: *Tides, *Bays, *Water circulation, Circulation, Currents(Water), Mathematical models, Model studies, Water levels, Wavelengths, Waves(Water), Ocean waves, Oceanography, *New Zealand, *Tasman Bay(New Zealand).

East-west current oscillations in Tasman Bay with a quarter (6.2 h), sixth (4.1 h) and eighth (3 h) diurnal periodicity were shown to be generated by non-linear field acceleration of the semi-diurnal tidal water motion near D'Urville Island resulting from rapid change of the tidal amplitude with distance. These over-tides force oscillations directed across (quarter and eighth-diurnal) and along (sixth-diurnal) Tasman Bay in which respective directions the quarter wavelength oscillation wave resonant periods are near the quarter and sixth diurnal period. (Sims-ISWS)
W80-00962

WIND-WAVE RELATIONSHIPS FOR A COASTAL SITE IN THE CENTRAL ENGLISH CHANNEL,
Southampton Univ. (England). Dept. of Civil Engineering.
G. Henderson, and N. B. Webber.
Estuarine and Coastal Marine Science, Vol 9, No 1, p 29-39, July 1979. 6 Fig, 4 Tab, 11 Ref.

Descriptors: *Waves(Water), *Coasts, *On-site investigations, *Forecasting, Analysis, Analytical techniques, On-site data collections, Wind velocity, Foreign research, Mathematical models, Correlation analysis, Winds, *England, *English channel, Wave height, Wind-wave relationships.

Waves have been recorded at a coastal site in the Central English Channel over a period of two years. By correlating wind and wave height data, empirical relationships were derived which were extrapolated to take account of the significantly longer period of wind data. By this means, both the long-term wave climate and the wave heights associated with storm conditions may be predicted for the more exposed wind sector. The method is relatively straightforward and capable of general application. (Humphreys-ISWS)
W80-01012

SEASONAL GEOSTROPHIC VOLUME TRANSPORTS ALONG THE SCOTIAN SHELF,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
K. Drinkwater, B. Petrie, and W. H. Sutcliffe, Jr.
Estuarine and Coastal Marine Science, Vol 9, No 1, p 17-27, July 1979. 7 Fig, 1 Tab, 21 Ref.

Descriptors: *Ocean circulation, *Currents(Water), *Continental shelf, *Atlantic Ocean, Coasts, Circulation, Seasonal, Variability, Sampling, Velocity, Flow, Data processing, Oceanography, *Nova Scotia coast, Geostrophic transport.

Mean monthly geostrophic volume transports were calculated through a transect across the Scotian Shelf known as the Halifax Section. The net alongshore volume transport over the shelf has an annual mean of 0.35 sverdrups (sv) to the southwest, being largest in winter (0.60 sv) and smallest in summer (0.15 sv). Flow over the inshore third of the shelf accounts for 75% of the calculated net annual transport. The source of this flow appears to be the Gulf of St Lawrence. (Sims-ISWS)
W80-01013

REMOVAL OF 'SOLUBLE' IRON IN THE POTOMAC RIVER ESTUARY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
For primary bibliographic entry see Field 5A.
W80-01014

SEDIMENTATION AND THE DISTRIBUTION OF ORGANIC MATTER IN A SUB-ANTARCTIC MARINE BAY,
British Museum of Natural History, London.
For primary bibliographic entry see Field 2J.
W80-01015

A MODEL FOR THE ESTIMATION OF THE CONCENTRATIONS AND SPATIAL EXTENT OF SUSPENDED SEDIMENT PLUMES,
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2J.
W80-01016

DISCUSSION OF THE BEHAVIOUR OF NON-CONSERVATIVE DISSOLVED CONSTITUENTS IN ESTUARIES,
Dartmouth Coll., Hanover, NH. Dept. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W80-01017

FORCED FORTNIGHTLY TIDES IN SHALLOW RIVERS,
British Columbia Univ., Vancouver. Dept. of Oceanography.
For primary bibliographic entry see Field 2E.
W80-01031

UNDULAR HYDRAULIC JUMPS AND THE FORMATION OF BACKLASH RIPPLES ON BEACHES,
Oregon State Univ., Corvallis. School of Oceanography.
R. Broome, and P. D. Komar.
Sedimentology, Vol 26, No 4, p 543-559, August 1979. 9 Fig, 1 Tab, 13 Ref. NOAA 04-7-158-44085.

Descriptors: *Beaches, *Sand waves, *Hydraulic jump, *Model studies, Wavelengths, Laboratory tests, On-site investigations, Hydraulics, Mathematical models, Ripple marks, Analytical techniques, Measurement, Beach erosion, Sediment transport, Hydraulic models, Undular hydraulic jumps.

Field observations were made of the formation of backwash ripples on the beach face, formed by undular hydraulic jumps generated by backwash down the beach face colliding with wave bores. Measured ripple wavelengths range from set averages of 48 to 70 cm. Within a particular set of ripples, the spacing tends to decrease in the offshore direction. These observations were compared with laboratory experiments where undular jumps were generated in a flume and with a computer simulation model which calculated both the flow within an undular hydraulic jump and the resulting sediment transport which gives rise to the backwash ripples. The computer model involved a numerical solution of the Boussinesq equations which govern the fluid flow and sediment transport equations which relate the sand transport rate to the local mean flow velocity. The model permitted a study of the detailed time-history of the undular jump development and the formation of the backwash ripples and showed good agreement with the field observations of backwash ripples, predicting an offshore decrease in their spacings. The laboratory experiments showed a similar result so long as the Froude number of the supercritical flow before the jump occurs is small ($F = 1.4$). Small differences between the computer model and experiments arose principally from the neglect of internal friction and surface tension in the model. (Humphreys-ISWS)
W80-01035

NUTRIENT CYCLING AND PRIMARY PRODUCTION IN PORT HACKING, NEW SOUTH WALES,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 5C.
W80-01122

PROCEEDINGS OF A WORKSHOP ON COASTAL ZONE RESEARCH IN MASSACHUSETTS (NOVEMBER 27-28, 1978),
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2J.
W80-01136

SINKING OF OIL IN LOS ANGELES HARBOR, CALIFORNIA FOLLOWING THE DESTRUCTION OF THE SANSINENA,
University of Southern California, Los Angeles. Environmental Geology Program.
For primary bibliographic entry see Field 5C.
W80-01151

ACCUMULATION OF PETROLEUM HYDROCARBONS IN A SALT MARSH ECOSYSTEM EXPOSED TO STEADY STATE OIL INPUT,
Louisiana State Univ, Baton Rouge. Dept. of Marine Science.
For primary bibliographic entry see Field 5C.
W80-01161

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

METHOD FOR THE DISTILLATION OF SEA WATER,
Hitachi, Ltd., Tokyo (Japan).
T. Narita, S. Yoshihara, Y. Ikenaga, and T. Iijima.
U.S. Patent No 4,152,218, 5 p, 1 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 205, May 1, 1979.

Descriptors: *Patents, *Desalination processes, *Water purification, *Separation techniques, Water quality control, Distillation, Flash distillation, Sulfur compounds, Absorption, Equipment, Waste gases.

The apparatus of the invention is used with a source producing waste gases containing sulfur oxides and includes means to directly contact such waste gases with sea water in order to absorb the sulfur oxides contained in the waste gases. A flue supplies waste gases; a conduit supplies the sea water; and a flue releases the treated waste gases. The device for the oxidation of sulfites which are produced by the absorption of sulfur oxides produces stable sulfates through a catalytic action of the metallic ions in the sea water. By distilling the sea water that had been used for the removal of sulfur oxides, the apparatus is compact in form in addition to reducing the cost, and does not require the special chemical pretreatments heretofore employed for supplemental sea water and distillation. (Sinha-OEIS)
W80-00875

CONVERSION OF SEA WATER BY REVERSE OSMOSIS,
Desalination Systems Inc., Escondido, CA. (Assignee).
D. T. Bray.
U.S. Patent No 4,156,645, 6 p, 1 Tab, 3 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1691, May 29, 1979.

Descriptors: *Patents, *Water treatment, *Desalination, Water purification, Reverse osmosis, Sea water, Saline water, Membrane processes, Semipermeable membranes.

A multistage process for recovery of fresh water by reverse osmosis from high salt content feed, such as sea water, comprises treating the feed water in an initial stage at relatively low pressure (between about 300 and 550 psi) employing a loose semipermeable membrane, to produce an intermediate product water containing one-fourth to one-half the TDS (total dissolved solids) content of the original feed water. The intermediate product water is treated in a subsequent stage also at a relatively low pressure (between about 300 and 550 psi) employing a tight semipermeable membrane, to produce a fresh product water containing less than 2,000 ppm TDS, and preferably a potable water containing less than 1,000 ppm TDS. (Sinha - OEIS)
W80-00908

A STUDY OF THE IN-SITU INDIRECT FREEZING PROCESS,
New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
C. Y. Cheng.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110992, Price codes: A05 in paper copy, A01 in microfiche. Final report submitted to Office of Water Research and Technology, July, 1979, 88 p, 53 Fig, 26 Ref, 2 Append. OWRT S-0060 No. 7502 (1).

Descriptors: *Separation techniques, *Desalination processes, *Crystallization, *Water desalting, Water purification, *Desalting apparatus, *Freezing, Waste water treatment, *Crystal growth, *Nucleation, High pressure, Ultrasonics, Phase diagram, Thermodynamics, Supercooling, Heat transfer, Energy, Melting, Sodium chloride, Permeability, Ice, Sea water, Brackish water, Brines, *In-situ, Indirect freezing, *Smooth deposit, *Dendritic deposit, In-situ washing, In-situ melting, Pressure-programmed supersaturation, Heat reuse, Two-pressure zone simultaneous freeze-melt operations, In-situ nucleation, Purification, Para-xylene, Styrene, Monomers.

It has been demonstrated that high degree separations of aqueous and organic mixtures can be accomplished and an energy saving can be realized by the In-situ Indirect freezing process conducted in a small conduit freezer-melter. The process has two versions: the first version, denoted as the dendritic deposit approach, is useful in accomplishing a high degree separation of a concentrated solution and the second version, denoted as the smooth deposit approach, is useful in a high degree purification of a dilute solution. A pressure-induced nucleation approach and a seeded feed approach with ultrasonic nucleation have been introduced to initiate a freezing step uniformly; a pressure-programmed supersaturation approach has been introduced to obtain a close control of delta t and a close control of the morphology of the deposited solid phase. Products containing less than 350 ppm NaCl were obtained from feeds containing 40,000 ppm and 5000 ppm, respectively, by the two approaches.
W80-01006

A STUDY OF THE VACUUM-FREEZING HIGH PRESSURE ICE-MELTING PROCESS,
New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
C. Y. Cheng.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111008, Price codes: A05 in paper copy, A01 in microfiche. Final Report submitted to Office of Water Research and Technology, June 1979, 70 p, 17 Fig, 20 Ref, 4 Append. OWRT S-0060 No 7502 (2). 14-34-0001-7502.

Descriptors: *Desalination processes, *Separation techniques, *Water desalting, Water treatment, Ice, Water purification, *Desalting apparatus, *Freezing, *Flash distillation, *Condensation, *Evaporation, Sea water, Brackish water, Waste water treatment, Vapor pressure,High pressure, Phase diagram, Heat transfer, Ice-Brine systems, Salinity, Latent heat, Energy, Economics, Feasibility, Thermodynamics, Kinetics, *Vacuum freezing processes, *Evaporative freezing operations,*Vapor desublimation, *High pressure ice-melting, *Ice-vapor interface, Extended surface freezer, Agitated freezer, Ice washing, Non-condensable gas.

An aqueous solution was flash vaporized under a reduced pressure to simultaneously form a low pressure water vapor and ice crystals. The ice formed was first purified in a counter-washer and then melted inside of heat conductive conduits under a high pressure (e.g. 500 atm.) and the low pressure water vapor was desublimed to form desublimate (ice) on the outside of the conduits. The latent heat of desublimation released was utilized in supplying the heat needed in the ice-melting operation. The desublimate was removed intermittently by an in-situ dissolution operation utilizing the feed solution and an equivalent amount of ice was formed inside of the conduits. The process uses components that are available commercially and can be reliably operated. The process is highly energy efficient and cost competitive with other desalination processes and conventional evaporation processes. The process is useful in desalination of brackish water and sea water and in concentrating industrial aqueous solutions.
W80-01007

3E. Conservation In Industry

PROCESS FOR CONTROLLING POLLUTION AND CONTAMINATION IN THE ELECTRODEPOSITION OF PAINT,
Nalco Chemical Co., Oak Brook, IL. (Assignee).
For primary bibliographic entry see Field 5D.
W80-00886

METHOD FOR RECOVERY OF METALS FROM METAL PLATING BATHS AND NEUTRALIZING TOXIC EFFLUENTS THEREFROM,
Instytut Mechaniki Precyzyjnej, Warsaw (Poland). (Assignee).
For primary bibliographic entry see Field 5D.
W80-01181

3F. Conservation In Agriculture

AGRICULTURAL IRRIGATION SYSTEM AND COMPONENTS THEREFOR,
B. Courtright.
U.S. Patent No 4,151,858, 11 p, 13 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 88, May 1, 1979.

Descriptors: *Patents, *Irrigation systems, *Application equipment, Irrigation practices, Irrigation efficiency, Lateral conveyance structures, Hydraulic equipment.

An agricultural irrigation wheel line has a line translational propulsion unit and also a series of torque assist or torque booster units spaced along the line. All of the units are hydraulically driven by water pressure in the irrigation line itself. The master unit is provided a coupling for the hose to be dragged over the field and coupled to a water-pressure source. Each of the units include a hydraulic jack which effects translation and principal line torquing, as the case may be. Controls are provided the units for regulating the stall-out condition of each unit, at which point the jack becomes inoperative to further apply torque to the line or to translate the line, as the case may be, in the event of a predetermined excessive torque resistance. Accordingly, the units speed up, slow down, or stall out, automatically in response to an undesired line condition, i.e. deflection or deviation from the essential rectilinear condition desired. Should the master unit, therefore, advance 'ahead' of the rest of the line, the torque resistance of loading of such unit will advance to a point where such master unit will automatically slow down and perhaps even stall out to wait for the other part or portions of the line to 'catch up'. The same likewise applies to the booster units coupled to mutually spaced points along the line. (Sinha-OEIS)
W80-00873

PART-CIRCLE SPRINKLER HEAD WITH IMPROVED QUICK-RETURN MECHANISM,
Nelson Irrigation Corp., Walla Walla, WA. (Assignee).
L. P. Meyer.
U.S. Patent No 4,153,202, 18 p, 10 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 536, May 8, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Irrigation practices, Irrigation efficiency.

In a part-circle sprinkler head preferably of the pressure compensating quick return type, the reactant structure on the reversing arm is provided with a coanda-effect surface which aids in moving

the reactant structure into the stream. The mechanism for disengaging the reactant structure of the reversing arm from the stream minimizes reliance upon inertia to effect the disengagement function by utilizing a secondary reactant element. The spring mechanism which stably maintains the reversing arm in its inoperative position is interrelated with the reversing arm so that the torque applied diminishes as the reversing arm moves toward its operative position within the stream. (Sinha-OEIS)
W80-00882

SOIL PENETRATION EMITTER FOR DRIP IRRIGATION SYSTEMS,
G. R. Hartman.
U.S. Patent No 4,153,380, 4 p, 4 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 597, May 8, 1979.

Descriptors: *Patents, *Irrigation systems, *Subsurface irrigation, Application equipment, Irrigation practices, Irrigation efficiency, Flow control, Drip irrigation.

An emitter device for a drip type irrigation system is described. The emitter has an elongated body with a tapered portion at its lower end to facilitate easy insertion into the soil. The upper end of the emitter forms a small receiving chamber connectable to an opening. An adjustable valve means is interposed between the chamber and the opening so that the flow of water from a suitable supply source can be regulated. Outlet openings for the emitter are located near or within the tapered portion of the body so that emission is accomplished below ground level. (Sinha-OEIS)
W80-00883

ADJUSTABLE SPRINKLER HEAD AND METHOD OF MAKING SAME,
R. B. Clawson.
U.S. Patent No 4,154,404, 5 p, 5 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 939, May 15, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Application equipment, Irrigation efficiency, Irrigation practices.

A simple, inexpensive sprinkler head may be adjusted to discharge a fluid in a full circular pattern of variable radius or in a variable size segment of the circular pattern. The structure of the sprinkler head includes a short tubular body having an array of apertures through the wall forming a closed elipse, together with a valve means for adjustment of the radius of the circular pattern of fluid discharge and a movable diaphragm for adjustment of the size of the segment of the circular pattern. The method of making such structure, including the fabrication of the tubular body in two parts by casting or molding techniques is disclosed. (Sinha-OEIS)
W80-00892

IRRIGATION SYSTEMS CONTROL,
Wade (R.M.) and Co., Portland, OR. (Assignee).
G. Cornelius, and L. C. Olson.
U.S. Patent No 4,155,679, 6 p, 3 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 982, No 4, p 1364, May 22, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Flow control, Irrigation practices, Irrigation efficiency, Valves, Application equipment.

An irrigation control system includes a rotary water motor operatively associated with valves to provide that the water motor is either in the full on or full off condition, dependent upon alignment of the irrigation line. The irrigation control system also includes a rotary water motor operatively associated with a valve, and a shut-down system is included for closing such valve upon loss of water pressure in a safety line. (Sinha - OEIS)
W80-00901

ROOT IRRIGATION DRIPILATOR DEVICE WITH SPRAY HEAD,
G. J. Konucik.
U.S. Patent No 4,156,396, 3 p, 4 Fig, 19 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1607, May 29, 1979.

Descriptors: *Patents, *Irrigation, *Subsurface irrigation, *Application equipment, Irrigation efficiency, Irrigation practices, Water delivery, Drip irrigation.

The object is to provide a root irrigation dripilator device which will provide irrigation to the roots of plants without wasting water upon the ground surface. The device consists of a main body with perforated sleeve means for insertion into a ground surface, for the purpose of introducing a controlled amount of water and liquid fertilizer to plant roots underground. It includes a manually controlled valve, and is connectable in plurality with similar units that will receive liquids from a drum. (Sinha - OEIS)
W80-00905

TRAP MEANS FOR CENTER PIVOT IRRIGATION SYSTEM,
Rainmatic International, Ltd. Honolulu, HI. (Assignee).
K. J. Hegemann.
U.S. Patent No 4,156,504, 5 p, 3 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1644, May 29, 1979.

Descriptors: *Patents, *Irrigation, Irrigation systems, Pipelines, Pollutants, Irrigation efficiency, Irrigation practices, Equipment, Flushing, Particulate matter.

An improved apparatus for flushing particulate matter from the pipeline of a center pivot irrigation system provides a length of downwardly extending pipe interposed in the pipeline in the immediate vicinity of or contiguous to the outermost mobile tower assembly of a plurality of such assemblies transporting the pipeline, permitting an operator standing on the ground to open the pipe during flushing. The downwardly extending pipe includes a restrictive opening for limiting the rate at which water is released from the pipeline during flushing. (Sinha - OEIS)
W80-00906

AUTOMATIC IRRIGATION SYSTEM FOR CONTROL VALVE ASSEMBLY,
W. Stan.
U.S. Patent No 4,158,441, 9 p, 8 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 983, No 3, p 535, June 19, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, Irrigation practices, Irrigation efficiency, Flow control, Valves, Soil moisture.

The main water valve to an irrigation system is connected by a fulcrum arm to a float chamber with a float connected to the arm. When the water is 'on' a controlled feed gradually fills the float chamber which shuts off the water when the float chamber is full. At this point a controlled bleed valve in the bottom of the float chamber gradually empties the float chamber and turns on the water when the float chamber is emptied thus timing the 'on' cycle and the 'off' cycle. By closing the controlled feed and fully opening the bleed valve, the water level in the ground can raise and lower the float so that irrigation is by soil moisture content rather than by time. In another embodiment the water in the float chamber raises and lowers air pressure in a sensing tube which acts upon a diaphragm which in turn is operatively connected to the fulcrum arm. Once again the actuation can be on a time basis or by the moisture content of the soil. (Sinha-OEIS)
W80-01184

LINEAR SPRINKLING IRRIGATION APPARATUS,
N. S. Standal.
U.S. Patent No 4,159,080, 20 p, 23 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 758, June 26, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Application equipment, Lateral conveyance structures, Automatic control.

The irrigation apparatus is designed to automate sprinkling of a field by use of a wheel-supported lateral pipeline having sprinklers spaced along a center pipeline axis. The apparatus is alternately in a stationary mode adapted to be hydraulically coupled to the water supply line through a selected water discharge valve, or in a traveling mode uncoupled from the water supply line and with the lateral pipeline powered for movement in a direction parallel to the supply line. The combination comprises a carriage guided along the water supply line, a structural fluid connection between the lateral pipeline and the carriage and sensing means for indexing the carriage by reference to a selected water discharge valve. A valve acuator on the carriage complete a hydraulic circuit from the water supply line to the lateral pipeline through the structural fluid connection. The entire apparatus is controlled sequentially from the carriage. (Sinha-OEIS)
W80-01187

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

AQUATIC HERBICIDAL DIACYLIMIDE COMPOSITIONS,
GAF Corp., New York. (Assignee).
L. Schneider, and D. E. Graham.
U.S. Patent No 4,154,594, 4 p, 3 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1003, May 15, 1979.

Descriptors: *Patents, *Water treatment, Aquatic weed control, Herbicides, Organic compounds, Chemical reactions, Diacylimide compounds.

The invention provides broad spectrum herbicidal diacylimide compositions. The compositions show excellent agricultural herbicidal activity, particularly against foxtail millet, Japanese millet, crabgrass and pigweed, and aquatic herbicidal activity against lower and higher submerged aquatic plants. The diacylimide compounds generally are prepared by reacting a suitable amide with an acyl halide. The acyl halide precursor may be prepared, if necessary, from the corresponding acid by reaction with a suitable halogenating agent, such as thionyl chloride. Similarly, a given amide may be readily prepared, for example, from the corresponding acyl halide by reaction with ammonia. (Sinha-OEIS)
W80-00894

PRE-MONSOON RAINFALL AND ITS VARIABILITY IN BANGLADESH: A TREND SURFACE ANALYSIS,
Windsor Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2B.
W80-01032

VEGETATION MANAGEMENT FOR WATER YIELD IMPROVEMENT IN THE COLORADO RIVER BASIN,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
A. R. Hibbert.
Available from the National Technical Information Service, Springfield, VA 22161 PB-300 379/AS, Price codes: A04 in paper copy, A01 in microfiche. Report, July 1979. 58 p, 13 Fig, 15 Tab, 129 Ref.

Descriptors: *Water yield improvement, *Colorado river basin, *Watershed management, *Snow management, *Clear-cutting, *Evapotranspiration control, Forest management, Land use, Brush, Forests, Runoff, Watersheds(basins).

Water yield from forest and rangelands can be augmented by managing vegetation and snow to reduce evapotranspiration. Methods of managing vegetation include clearing, type conversion, patch cutting, and thinning. Snow can be trapped in forest openings and by snow fences in windswept treeless areas to reduce evaporation of windblown snow and concentrate snowmelt to enhance its delivery to streams. Some arbitrary augmentation goals were chosen to illustrate the potential for increasing water yield, and treatments were hypothesized to get these increases. Most of the water produced by vegetation management would be cheaper than imported water, and some of it from commercial forests would be in the price range of water produced by weather modification. W80-01164

4B. Groundwater Management

WATER-LEVEL CHANGES IN SOUTHWESTERN KANSAS, 1940-78,
Geological Survey, Garden City, KS. Water Resources Div.
M. E. Pabst, and E. D. Gutentag.
Kansas Geological Survey Journal, 1979. 29 p, 1 Fig, 2 Plates, 6 Tab, 28 Ref.

Descriptors: *Water levels, *Groundwater, *Water level fluctuations, *Irrigation wells, *Kansas, Aquifer characteristics, Hydrogeology, Water wells, Pumping, Drawdown, Water table, Zone of saturation, Hydrologic data, Alluvial aquifers, Unconsolidated aquifers, *Southwestern Kansas, Ogallala formation, Undifferentiated pleistocene deposits.

From 1940 to January 1978, the number of irrigation wells in southwestern Kansas has increased from about 520 to 8,250, and estimated annual ground-water withdrawals have increased from 90,000 to 3,500,000 acre-feet. The principal water-yielding formations (unconsolidated aquifer) supplying water to wells are the Ogallala Formation of Pliocene age and the undifferentiated Pleistocene deposits. Water-level measurements are made each January, a time when there is little pumping. Water levels in wells in unconsolidated deposits have declined as much as 172 feet since 1940 in parts of southwestern Kansas, primarily as a result of ground-water withdrawals for irrigation. The median water-level decline from 1940 to January 1978, is 19 feet, and the median percentage decrease in saturated thickness is 11 percent. (Woodard-USGS)
W80-00923

SUPPLYING WATER TABLE INTAKE THROUGH AGRICULTURAL USE OF URBAN SEWAGE,
Institute of Land Improvement in Green Lands, Wroclaw (Poland).
For primary bibliographic entry see Field 5E.
W80-00987

4C. Effects On Water Of Man's Non-Water Activities

QUANTITY AND QUALITY OF URBAN RUNOFF FROM THREE LOCALITIES IN THE DENVER METROPOLITAN AREA,
Geological Survey, Lakewood, CO. Water Resources Div.
S. R. Ellis, and W. M. Alley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 859, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-64, May 1979. 60 p, 25 Fig, 21 Tab, 17 Ref.

Descriptors: *Urban runoff, *Rainfall-runoff relationships, *Storm runoff, *Snowmelt, *Water quality, Model studies, Water analysis, Chemical analysis, Heavy metals, Chlorides, Nitrogen, Colorado, *Denver area.

Considerable variation in constituent concentrations was shown in urban runoff data for 1975-77 from three metropolitan Denver drainage basins. Constituent concentrations, greatest during initial rainfall runoff, generally peaked midday of snowmelt runoff, corresponding with maximum melting and runoff. Instantaneous loads of constituents were largely a function of discharge. Days since last street sweeping or antecedent precipitation had no apparent effect; snowmelt-runoff loads apparently increased with number of days snow had been on the ground. Urban storm runoff may significantly contribute total ammonia nitrogen, total nonfiltrable residue, total copper, total iron, total lead, and total zinc; and snowmelt runoff may significantly contribute sodium and chloride, to local receiving waters. Data from two basins were used for calibration and verification of U.S. Environmental Protection Agency's Storm Water Management Model II for rainfall-runoff modeling of flow and total nitrogen. The model assumption that land-surface loads of total nitrogen are directly proportional to number of days prior to storm during which accumulated rainfall was less than 1.0 inch was not substantiated. (Woodard-USGS)
W80-00927

PARTIAL DROUGHT CONDITIONS IN NEPAL,
Ground Water Resources Development Board, Kathmandu (Nepal).
For primary bibliographic entry see Field 2B.
W80-01033

4D. Watershed Protection

DUAL-PURPOSE DETENTION BASINS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 5G.
W80-00975

PRE-MONSOON RAINFALL AND ITS VARIABILITY IN BANGLADESH: A TREND SURFACE ANALYSIS,
Windsor Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2B.
W80-01032

MODELS FOR PREDICTING WATER POLLUTION FROM AGRICULTURAL WATERSHEDS,
Science and Education Administration, Chickasha, OK. Southern Great Plains Watershed Research Center.
For primary bibliographic entry see Field 5C.
W80-01133

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

MASOTEN (DYLOX) AS A CONTROL FOR CLAM SHRIMP IN HATCHERY PRODUCTION PONDS,
Fish and Wildlife Service, San Marcos, TX. Fish Cultural Development Center.
J. P. McCraren, J. L. Millard, and A. M. Woolven.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 329-331, 1977. 4 Ref.

Descriptors: *Shrimp, *Pesticide toxicity, *Fish management, Growth stages, Fry, Plankton, Benthic fauna, Fish hatcheries, Turbidity, Organophosphorus pesticides, Bioassay, Mortality, Bass, *Masoten.

Information relative to control of problematical clam shrimp with Masoten (Dylox) was accumulated over a 10 yr period at several Southwestern hatcheries. Laboratory and field studies showed that control could be achieved with single applications of Masoten as low as 0.01 mg/l (active ingredient). No deleterious effects on fry, fingerlings, or adult fish of several species were noted. Decomposition of the chemical, as well as effects on plankton and bottom fauna, are discussed. The paper places on record the efficacy of Masoten against clam shrimp, a level of treatment for same, and a suggested approach to control. (Deal-EIS)
W80-00802

THE EFFECTS OF HEATED WATER ON WARMWATER FISH IN EARTHEN RACEWAYS,
Alabama Univ., Auburn. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 5C.
W80-00803

EVALUATION OF AN AIR-BUBBLE CURTAIN TO REDUCE IMPINGEMENT AT AN ELECTRIC GENERATING STATION,
Texas Instruments Inc., Dallas, TX. Ecological Services.
P. J. Zweiacker, J. R. Gaw, E. Green, and C. Adams.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 343-356, 1977. 8 Fig, 5 Tab, 21 Ref.

Descriptors: *Entrainment, *Seasonal, *Fish populations, Fish barriers, Fish behavior, Intakes, Powerplants, Water temperature, Cooling water, Growth stages, Thermal stress, Nuclear powerplants, Arkansas, Dardanelle Reservoir, *Shad, Air bubble curtain.

A biological testing program was conducted during 1974-75 to determine the efficiency of an air-bubble curtain in reducing fish impingement at Arkansas Nuclear-One Unit 1, on Dardanelle Reservoir, AR. Air curtain operation did not effectively deter fish from entering the intake canal or substantially reduce impingement. Seasonal variations in species composition and length-frequency distribution of impinged fish were independent of air curtain operation. There was a significant inverse correlation between water temperature and impingement levels during fall 1974 and spring 1975. Highest impingement rates occurred during late fall, winter, and early spring, regardless of air curtain status. Impinged individuals were predominantly young-of-the-year-fish, especially threadfin (Dorosoma petenense) and gizzard shad (D. cepedianum), assumed to be thermally stressed by low (< 15.5 C) water temperatures. (Deal-EIS)
W80-00804

SALINITY STRESS AND SWIMMING PERFORMANCE OF SPOTTED SEATROUT,
Texas, Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
J. M. Wakeman, and D. E. Wohlschlag.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 357-361, 1977. 3 Fig, 16 Ref.

Descriptors: *Salinity, *Toxicity, *Fish behavior, Salt tolerance, Fish physiology, Water temperature, Saline water fish, Habitats, Statistical analysis, Laboratory tests, Stress, *Seatrout, *Cynoscion.

Specific swimming speeds of spotted seatrout (Cynoscion nebulosus) were linearly related ($S = -0.16+0.93X$) to tail-beats/sec (x) over speeds ranging from about 1.5 - 4.0 length/sec. Maximum sustained swimming speeds were measured at salinities ranging from 10 10 to 45 ppt in intervals of 5 ppt. At about 20 to 25 ppt, maximum sustained swimming speeds were close to 4 lengths/sec, but performance was reduced at salinities above or below this range. At 45 ppt, maximum sustained speeds were only about 2 lengths/sec. These results indicate that maximum sustained swimming performance can provide an effective method for evaluating salinity stresses. (Deal-EIS)
W80-00805

EFFECTS OF MASOTEN (DYLOX) ON PLANKTON IN EARTHEN PONDS,

Fish and Wildlife Service, San Marcos, TX. Fish Cultural Development Center.
J. P. McCraren, and T. R. Phillips.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 441-448, 1977. 6 Fig, 2 Tab, 13 Ref.

Descriptors: *Pesticide toxicity, *Phytoplankton, *Zooplankton,Copepods, Rotifers, Crustaceans, Organophosphorus pesticides, Pesticide residues, Chemical degradation, Fish parasites, Bioassay, Fish management, Water chemistry, *Masoten.

The effects of Masoten, an organophosphate parasiticide, on phytoplankton and zooplankton in earthen ponds were studied. In 2 separate trials, 3 ponds (0.04 ha) received a single application of Masoten at a rate of 0.25 mg/l (active ingredient) and 3 ponds served as untreated controls. Net plankton samples were collected at pre-treatment, and 5, 24 and 48 hrs following treatment. Toxic effects were based on quantitative-qualitative plankton analyses. Phytoplankton and rotifers were unaffected by treatment. The copepod Diaptomus sp. and nauplii were also unaffected. However, variability in response of copepods and nauplii to Masoten can be anticipated. Cladocerans were the most sensitive to Masoten; losses are to be expected when the compound is employed for control purposes. Information regarding residues and decomposition of Masoten is presented. (Deal-EIS)
W80-00807

EFFECTS OF A PUMPED STORAGE HYDROELECTRIC PLANT ON RESERVOIR TROUT HABITAT,
Fish and Wildlife Service, Clemson, SC. Southeast Reservoir Investigations.
J. L. Oliver, P. L. Hudson, and J. P. Clugston.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 449-457, 1977. 4 Fig, 2 Tab, 12 Ref.

Descriptors: *Trout, *Toxicity, *Thermal pollution, *Thermocline, Habitats, Rainbow trout, Thermal stratification, Cooling water, Powerplants, Water temperature, Dissolved oxygen, South Carolina, Jocassee Reservoir, Hydroelectric plants, Pumped storage, Brown trout.

Jocassee Reservoir is the upper pool for a 610-MW pumped storage hydroelectric plant in northwestern South Carolina. Trout have been stocked annually since 1972. The volume of trout habitat during summer has decreased annually from 1973 to 1976, and is associated with increases in the temperature and volume of water pumped from the lower reservoir. The top of the thermocline during September was lowered from about 9 m in 1973 to nearly 19 m in 1976, and trout habitat was reduced by about 65%. On the basis of a regression presented, we predict that trout habitat will be reduced to nil when plant operation reaches 63% of capacity (perhaps by 1981). (Deal-EIS)
W80-00808

EFFECT OF TEMPERATURE ON WALLEYE EGG HATCH RATE,
Texas Parks and Wildlife Dept., Ingram.
J. A. Prentice, and W. J. Dean, Jr.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 458-462, 1977. 1 Fig, 1 Tab, 9 Ref.

Descriptors: *Water temperature, *Inhibition, *Fish reproduction, *Walleye, Toxicity, Heated water, Fish physiology, Fish management, Reservoirs, Spawning, Fecundity, Fish eggs, Thermal stress.

This study was conducted to determine if water temperature increases during the walleye (Stizostedion vitreum vitreum) spawning period reduced egg hatch rate and if water temperature manipulation during egg fertilization would increase hatch rate. Walleye eggs were subjected, before and during fertilization, to 1 of 3 treatments involving water temperatures above and below 12C. Water temperatures above 12C were found to reduce hatch rates. Stripping and fertilizing eggs collected from reservoir water temperatures above 12C into water chilled to 7.2C significantly increased hatch rates. Use of this technique could improve walleye culture and management operations in some southern regions. (Deal-EIS)
W80-00809

REPRODUCTION REPRESSION OF LARGEMOUTH BASS IN A HEATED RESERVOIR,
Texas Parks and Wildlife Dept., San Antonio.
W. J. Dean, and W. H. Bailey.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 463-470, 1977. 1 Fig, 5 Tab, 31 Ref.

Descriptors: *Fish reproduction, *Reservoirs, *Bass, Water quality, Spawning, Powerplants, Cooling water, Fish management, Inhibition, Fish physiology, Water chemistry, Growth stages, Mortality, Fish eggs, Texas, Victor Braunig lake, Calaveras Lake, Reproduction.

This study investigated possible factors inhibiting spawning of largemouth bass (Micropterus salmoides) in Victor Braunig Lake, a 547 ha power plant cooling reservoir in Bexar County, TX. Data on water quality, fish communities, pesticide and heavy metal concentrations and largemouth bass blood components and sexual development were analyzed from Braunig Lake and Calaveras Lake, a similar power plant lake nearby. All factors were similar between the 2 lakes. Largemouth bass from Braunig Lake began spawning 2 days after being moved to hatchery ponds. Largemouth bass from Calaveras Lake which had a normally reproducing population failed to spawn in pens in Braunig Lake. Braunig Lake largemouth bass had no chronic abnormalities that would inhibit spawning. Reproductive failure was apparently not due to poor water quality, over-abundance of other fishes, parasite infestations, unusual blood components, pesticide or heavy metal contamination, spawning substrate deficiencies or egg or fry mortality. The exact cause of the spawning repression was not identified. However, this study examined many factors associated with reproductive failure in largemouth bass and demonstrated a potential problem facing fishery managers of power plant lakes. In reservoirs where spawning does not occur, supplemental stockings will be necessary to sustain largemouth bass fisheries. (D-EIS)
W80-00810

MIGRATION OF SAUGER PAST A THERMAL DISCHARGE IN MELTON HILL RESERVOIR,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries and Wildlife Development.
R. W. Schneider, W. K. Wilson, and B. L. Evenhuis.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 538-545, 1977. 5 Fig, 2 Tab, 10 Ref.

Descriptors: *Sauger, *Fish migrations, *Heated water, Tennessee River, Fish physiology, Thermal pollution, Thermal powerplants, Outlets, Water temperature, Heat resistance, Seasonal, Tagging, Electro-fishing, Bull Run Steam Plant, Fish behavior.

A total of 259 sauger (Stizostedion canadense) was tagged and released downstream of Bull Run Steam Plant during the winters of 1974-75 and 1976. Gill nets and electrofishing gear were used to recapture sauger that moved into the discharge basin or past the plant. Over the study period 7 sauger were recaptured upstream from the discharge; 3 of these had moved past the plant while it was continuously operating. Fourteen sauger were caught in the discharge. The thermal plume from Bull Run Steam Plant had no significant effect on the movement of sauger. (Deal-EIS)
W80-00811

EFFECTS OF GAS SUPERSATURATION ON FISH IN THE COLUMBIA RIVER,
National Marine Fisheries Service Seattle, WA.
G. R. Snyder, R. J. McConnell, and T. H. Blahm.
In: Proceedings of the Symposium on Terrestrial and Aquatic Ecological Studies of the Northwest, March 26-27, 1976, EWSC Press, Cheney, Washington, p 219-232. (1976) 6 Fig, 4 Tab, 8 Ref.

Descriptors: *Supersaturation, *Dissolved oxygen, Fish diseases, *Gas-bubble disease, Dams, *Columbia River, Bioassays, Nitrogen, Depth, Laboratory tests, Fish migrations, Juvenile fish, Swimming depth, Fish physiology, Fish behavior, Mortality, Chinook salmon, Coho salmon, Rainbow trout, Vertical distribution, Stress.

Tests have been conducted at the Prescott Field Facility of the National Marine Fisheries Service (NMFS) to determine effect of dissolved gas supersaturation on the survival of fish indigenous to the Columbia and Snake Rivers. Bioassay tests have provided information necessary to rank several species of fish by tolerance to gas supersaturation. Increased swimming depth enhances survival; therefore, the depth distribution of fish in the river was examined to accurately estimate fish mortality. A sonic detection array was developed and has been used to determine the swim-depth patterns of migrating juvenile salmonids. Tests conducted to determine if fish can detect and avoid gas supersaturated conditions indicated variation in sensitivity among different species of salmonids. Exposure of selected species of fish to gas supersaturated and equilibrated water on an intermittent time basis indicated all species had better survival under these conditions than those exposed to constant high saturation conditions. Various physiological tests were conducted to determine effects of gas supersaturation on: (1) stamina, which was adversely affected, and (2) oxygen consumption, which increased under high gas concentrations, indicating stress. (Katz-EIS)
W80-00814

AUTOMATIC CULTURE SYSTEMS FOR GROWING LAMINARIA SACCHARINA (PHAEOPHYCEAE) AND TESTING THE EFFECTS OF POLLUTANTS,
Biologische Anstalt Helgoland, Hamburg (Germany, F.R.).
J. W. Markham, K. Luning, and K-R. Sperling.
In: Proceedings of the Ninth International Seaweed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 153-159, 1977. 1 Fig, 5 Ref.

Descriptors: *Cultures, *Phaeophyta, Plant growth, Growth rates, Bioassay, *Bioindicators, Toxicity, Marine plants, Benthic flora, Analytical techniques, *Cadmium, Heavy metals, Laminaria.

An automatic culture system has been developed to produce fast-growing young sporophytes of Laminaria saccharina of known age in a unialgal condition from stock cultures of gametophytes whenever required. Sporophytes 50-60 mm long can be produced in 7 wk. Sporophytes 7 wk old have been used in 6-day pollution experiments. In the continuous-flow system used for testing pollutants, the control plants increase their length by a factor of at least 3 during the 6 days. The growth rate of the plants subjected to pollution thus provides a sensitive parameter for the measurement of pollution effects and gives good reproducibility. (Deal-EIS)
W80-00817

EFFECT OF PULP MILL EFFLUENT ON PRODUCTIVITY OF SEAWEEDS,
Nova Scotia Research Foundation, Dartmouth.
K. Hellenbrand.
In: Proceedings of the Ninth International Seaweed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 161-171, 1977. 3 Fig, 9 Ref.

Descriptors: *Pulp wastes, *Toxicity, *Productivity, *Marine plants, Pulp and paper industry, Photosynthesis, Respiration, Nutrients, Plant physiology, Tertiary treatment, Bioassay, Outlets, *Fucus, *Ascophyllum, *Chondrus, *Seaweeds.

The effect of treated kraft mill effluent on rates of net photosynthesis and respiration of Chondrus crispus, Ascophyllum nodosum and Fucus vesiculosus was studied. Four types of experiments were carried out: (1) short (up to 14 days) and (2) long term (180 days) experiments in the laboratory with effluent concentrations of 2-50% and 0.5-2%, respectively. (3) In the field plants from an unpolluted site were transferred to sites near the effluent outfall and studied over a period of 4 mo. with effluent concentration 0.8-24%. (4) Plants growing near the outfall were compared with plants at an unpolluted control site. Under laboratory conditions, only Fucus showed reduced productivity in the presence of effluent. In the field productivity of all seaweeds was increased probably due to nutrients in the effluent. It is concluded that with the described method it may be possible to detect subacute effects of effluents on seaweeds. (Deal-EIS)
W80-00818

COMPOSITION OF BENTHIC MARINE ALGAE IN RELATION TO POLLUTION IN THE SETO INLAND SEA, JAPAN,
Kobe Univ. (Japan). Dept. of Botany.
H. Hirose.
In: Proceedings of the Ninth International Seaweed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 173-179, 1977. 2 Fig, 1 Tab.

Descriptors: *Marine algae, *Bioindicators, Phaeophyta, Chemical oxygen demand, Industrial wastes, Municipal wastes, Water quality, Dominant organisms, Water chemistry, Chlorophyta, Rhodophyta, *Species diversity, Japan, Seto Inland Sea.

As the pollution of the Seto Inland Sea has increased alarmingly, the change in the composition of benthic vegetation was investigated. The indicator algae that suggest water quality were identified. In the sea area of western Kobe the COD (chemical oxygen demand) is lowered gradually in a comparatively short distance. The present study showed that some brown algae (Dictyotaceae, Sargassaceae) were the least tolerant algae (COD < 1.5 ppm) and Ulvaceae (green algae) were the most tolerant (COD > 3.0 ppm). (Deal-EIS)
W80-00819

SENSITIVITY OF SOME BROWN ALGAL REPRODUCTIVE STAGES TO OIL POLLUTION,
Environmental Research Lab., Narragansett, RI.
R. L. Steele, and M. D. Hanisak.
In: Proceedings of the Ninth International Seaweed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 181-190, 1977. 5 Tab, 4 Ref.

Descriptors: *Oil pollution, *Toxicity, *Phaeophyta, *Bioassay, Oil, Reproduction, Germination, Plant growth, Plant physiology, Spores, Resistance, *Fucus, *Laminaria, Methodology.

Fucus and Laminaria are considered as bioassay organisms for oil as they are sensitive to oil, especially during gamete or spore release. Concentrations as low as 2 ppb blocked fertilization in Fucus, apparently due to toxic effects on the sperm. Laminaria spores did not germinate at concentrations above 20 ppb. Male gametophytes of Laminaria were more sensitive to oil than females, and sporophyte development was substantially decreased in the presence of oil. This study indicated not only the potential use of these species as bioassay organisms, but also that subtle ecological effects may be felt by the algal community in areas of chronic, low level oil pollution. (Deal-EIS)
W80-00820

UPTAKE, BIOTRANSFORMATION, DISPOSITION, AND ELIMINATION OF 2-METHYLNAPHTHALENE AND NAPHTHALENE IN SEVERAL FISH SPECIES,
Medical Coll. of Wisconsin, Milwaukee. Dept. of Pharmacology.
M. J. Melancon, Jr., and J. J. Lech.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 5-22, 1979. 5 Fig, 5 Tab, 19 Ref.

Descriptors: *Organic compounds, *Path of pollutants, *Fish physiology, Carbon radioisotopes, Tracers, Absorption, Chromatography, Chemical properties, Chemical analysis, Rainbow trout, Carp, Biodegradation, Animal metabolism, Enzymes, Sunfishes, *Naphthalenes, *Biotransformation, *Tissue analysis, Methylnaphthalene.

The uptake, disposition, biotransformation, and elimination of 14C-2-methylnaphthalene and 14C-naphthalene have been studied in several species of fish. The half-lives of elimination of 14C from several tissues, following the exposure of rainbow trout fingerlings to both compounds for 8 h, were less than 24 h. After exposure of the trout to 14C-napthalene for four weeks, the half-life of elimination was hundreds of hours. After exposure to 14C-2methylnaphthalene for four weeks, the elimination of 14C was biphasic; the rapid phase of elimination had a half-life of less than 24 h while the half-life of the slow phase was hundreds of hours. Examination of the muscle 14C by thin-layer chromatography (TLC) suggested that differential elimination of the parent compound and its metabolites may be involved in these differences. The elimination of 14C from fingerling carp after four weeks of exposure to 14C-2-methylnaphthalene, was also biphasic. Bile 14C from rainbow trout, carp, and sheepshead which had been exposed to 14C-2-methylnaphthalene, was present mainly as metabolites. Most of the metabolites appeared to be conjugated when examined by TLC. (Deal-EIS)
W80-00821

AN ASSESSMENT OF DDT TOXICITY ON OSMOREGULATION AND GILL NA,K-ATPASE ACTIVITY IN THE BLUE CRAB,
Emporia State Univ., KS. Div. of Biological Sciences.
G. J. Neufeld, and J. B. Pritchard.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds. American Society for Testing and Materials, p 23-34, 1979. 3 Fig, 1 Tab, 37 Ref.

Descriptors: *Pesticide toxicity, *Osmosis, *Crabs, *DDT, Membrane processes, Animal physiology, Enzymes, Sodium, Potassium, Inhibition, Animal metabolism, Mode of action, Chemical analysis, Ion exchange, Crustaceans, Chlorinated hydrocarbon pesticides, *Tissue analysis.

The sodium, potassium adenosine triphosphatase (Na,K-ATPase) of the gill is responsible for the ability of the blue crab, (Callinectes sapidus), to maintain serum osmolality in dilute environments. Thus, the inhibition of this enzyme might lead to osmoregulatory failure. To determine whether this mechanism plays a role in DDT toxicity in the blue crab, the effects of DDT on gill Na,K-ATPase activity and osmoregulation were examined in adult crabs. When DDT was presented to gill homogenates in vitro, Na,K-ATPase was significantly inhibited at a concentration of 1.0 ppm DDT. Essentially maximal inhibition occurred at 9.0 ppm. The injection of a sublethal dose of DDT (0.3 ppm) into the live animal produced a temporary decline in hemolymph osmolality. However, by 28 h after transfer of the animal to a dilute environment, the values for osmolality and Na,K-ATPase activity were virtually identical to those of controls. Since the intact animal had either (1) rapid induction, or activation, of new Na,K-ATPase activity or (2) excess sodium transport capacity protects the crab from osmoregulatory difficulty. (Deal-EIS)
W80-00822

ACEPHATE AND FENITROTHION TOXICITY IN RAINBOW TROUT: EFFECTS OF TEMPERATURE STRESS AND INVESTIGATIONS ON THE SITE OF ACTION,
National Inland Fisheries Inst., Bangkok (Thailand).
M. Duangsawasdi, and J. F. Klaverkamp.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds. American Society for Testing and Materials, p 35-51, 1979. 8 Fig, 67 Ref.

Descriptors: *Rainbow trout, *Organic compounds, *Pesticide, Toxicity, Path of pollutants, Mode of action, Water temperature, Thermal stress, Fish physiology, Enzymes, Inhibition, Phosphothioate pesticides, Chemical properties, Chemical analysis, Lipids, *Acephate, *Fenitrothion, *Tissue analysis.

The detection of organophosphate (OP) insecticide pollution in natural waters requires knowledge of the physiological target sites and the mechanism of action of these chemicals in fish. This study was designed to determine the acute lethality of acephate (ATE), a phosphoramidothioate, and fenitrothion (FTN), a phosphorothionate, on rainbow trout fingerlings at three test temperatures; the sublethal effects of ATE and FTN on heart rate (HR), ventilation rate (VR), buccal amplitude (BA), and cough frequency (CF) in adult rainbow trout; and the effects of ATE and FTN on the brain, erythrocyte, gill, heart, serum, and skeletal muscle cholinesterase inhibition (ChE1) in these fish. From our results, the LC50 values of ATE were approximately 600 to 1000 times greater than those of FTN. Temperature affected the LC50 values, median survival times, and slopes of mortality curves of FTN, but not those of ATE. Both insecticides produced a decrease in HR, and an increase in VR and BA. FTN produced an increase in CF, but ATE did not. The cholinesterase activity in the erythrocytes, gill, heart, and serum showed marked inhibition after 3 h of exposure to ATE, compared with 1 h of exposure to FTN. More time was required to attain maximal inhibition in the brain and skeletal muscle than in other tissues. This study indicates that the cardiovascular and respiratory systems in fish are important sites of action for OP toxicity, and that this toxicity depends on physicochemical properties, for example, lipid solubility, and on environmental factors, for example, temperature. (Deal-EIS)
W80-00823

RELATIONSHIP OF THE PHYSIOLOGY OF AQUATIC ORGANISMS TO THE LETHALITY OF TOXICANTS: A BROAD OVERVIEW WITH EMPHASIS ON MEMBRANE PERMEABILITY,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
B. Katz.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 62-76, 1979. 11 Fig, 35 Ref.

Descriptors: *Membrane processes, *Toxicity, *Ammonium compounds, Ammonia, Biological membranes, Chlorine, Heavy metals, Osmosis, *Zinc, *Cadmium, *Copper, Nickel, Sodium, Permeability, Chemical properties, Mode of action, *Gills, *Tissue analysis, Fish physiology, Membrane permeability.

A mechanism is proposed to explain differences in acute toxicity to different species caused by substances that form stable ammonia complexes. These substances include chlorine and various heavy metals. A deficiency in osmoregulation, resulting in damage to the gill but not the skin epithelia, is discussed in relation to varying degrees of toxicity affecting a wide spectrum of aquatic organisms. (Deal-EIS)
W80-00825

RESPIRATORY ACTIVITY OF FISH AS A PREDICTOR OF CHRONIC FISH TOXICITY VALUES FOR SURFACTANTS,
Proctor and Gamble Co., Cincinnati, OH. Ivorydale Technical Center.
A. W. Maki.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 77-95, 1979. 6 Fig, 7 Tab, 28 Ref.

Descriptors: *Surfactants, *Bioassay, *Sunfishes, Methodology, Analytical techniques, Toxicity,

Fish physiology, Respiration, Water quality, Monitoring, Organic compounds, Linear alkylate sulfonates, *MATC.

A system was developed to monitor the ventilation frequency of bluegills (Lepomis macrochirus) under continuous-flow exposure to test compounds. The nerve-action potential associated with the opening and closing of the cbuccal cavity, branchial arches, and operculum was simultaneously monitored for 16 fish, four each from three exposure concentrations and four controls. The system was used to determine the effects of several representative surfactants on the diurnal respiratory activity of the test fish. The test compounds were selected on the basis of previously existing full-life-cycle chronic fish data with which to compare the respiratory data. Good correlations are demonstrated between the chronic maximum acceptable toxicant concentration for fathead minnows and the concentrations of surfactants that elicit statistically significant changes in the diurnal ventilation frequencies of exposed bluegills. A simplified statistical procedure, employing the log 10 of observed rates, was developed, allowing determination of the changes in rates over the entire day and night exposure periods. It appears that the monitoring of aberrant respiratory activity in bluegills for a two-day period has potential predictive value as a scanning tool for a rapid prediction of chronic fish toxicity values. (Deal-EIS)
W80-00826

USE OF LUMINESCENT BACTERIA FOR DETERMINING TOXICITY IN AQUATIC ENVIRONMENTS,
Beckman Instruments, Inc., Carlsbad, CA.
A. A. Bulich.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 98-106, 1979. 3 Fig, 3 Tab, 3 Ref.

Descriptors: *Bioassay, *Bioluminescence, *Toxicity, *Organic compounds, Monitoring, Methodology, Analytical techniques, Bacteria, Surfactants, Water quality, Light intensity, *Chlordane, *Pentachlorophenol, *Carbon tetrachloride.

A simple rapid method for monitoring the toxicity of aquatic samples has been developed. The assay is based on changes in the light output of luminescent bacteria, as measured in a photometric device. Under suitable conditions, selected strains of luminescent bacteria emit a constant amount of light as a metabolic byproduct. On exposure to toxicants, the light intensity is quickly diminished by an amount which is proportional to the concentration of the toxicant. An initial comparison of this new method with a 96-h acute fish toxicity test suggests that the bacterial test compares favorably in sensitivity with other tests while being more simple and rapid to perform. Data can be obtained in two to five minutes. Some examples of demonstrated sensitivities (in mg/litre) are: pentachlorophenol, 0.005; carbon tetrachloride, 6.0; sodium lauryl sulfate, 1.0; chlordane, 0.6; and sodium hypochlorite, 0.005. (Deal-EIS)
W80-00827

TAINT THRESHOLD OF DIPHENYL OXIDE IN RAINBOW TROUT,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
D. R. Branson, G. E. Blau, H. C. Alexander, and T. L. Peters.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 107-121, 1979. 4 Fig, 3 Tab, 1 Append, 12 Ref.

Descriptors: *Rainbow trout, *Bioindicators, *Taste, Chemical analysis, Path of pollutants, Fish physiology, Chemical wastes, Chemical properties, Organic compounds, Water quality, *Diphenyl oxide, *Fish-taint test, *Tissue analysis, *Bioaccumulation.

Rainbow trout were exposed continuously for seven days to sublethal concentrations of diphenyl oxide (DPO) in water. The trout flesh was then analyzed for taste and DPO concentrations. The following conclusions were based on the experimental results: (1) Trout flesh containing 7.5 + or - 1.2 micrograms/g DPO was identified by a panel as characterizing the breakpoint between tainted and untainted taste. Trout exposed continuously to 16 micrograms/litre of DPO in the water for one week show flesh concentrations of DPO that correspond to this fish-taint threshold. (2) The DPO concentrations in trout flesh increased 1.75 times after baking. This phenomena could be due to water loss and to possible transfer of DPO from the skin to the flesh during baking. Cooked trout flesh containing 13 + or - 2 micrograms/g DPO were at the fish-taint threshold. (3) A statistically significant correlation was obtained between fish-taint scores and the DPO concentration in flesh, which permits the prediction of fish taint to be made from a given DPO residue in fish. (4) Statistical analysis of the taste data indicated that neither taste fatigue nor taster experience was a factor in this study. (5) This study illustrates that taint in fish can be one of the more sensitive water quality criteria for some chemicals. (Deal-EIS)
W80-00828

VALUE OF CHEMICAL FRACTIONATION FOR IDENTIFYING THE TOXIC COMPONENTS OF COMPLEX AQUEOUS EFFLUENTS,
Oak Ridge National Lab., TN.
B. R. Parkhurst, C. W. Gehrs, and I. B. Rubin.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 122-130, 1979. 2 Tab, 12 Ref.

Descriptors: *Analytical techniques, *Bioassay, *Daphnia, *Toxicity, Chemical analysis, Chemical wastes, Fuels, Coals, Acids, Alkalis(Bases), *Synthetic fuels.

Chemical fractionation can be used to separate complex aqueous effluents into several less complex fractions. This technique has been combined with mutagenesis testing to provide an effective means of screening the potential health hazards of products and of aqueous effluents. The purpose of this study was to evaluate the applicability of combining chemical fractionation with acute toxicity testing as a method of identifying and quantitatively assessing those components of a synthetic fuel process effluent that are toxic to aquatic biota. A representative synthetic fuel effluent was fractionated into three organic fractions (acid, base, and neutral) and an inorganic fraction. The original effluent, the fractions, and a reconstituted effluent were tested for acute toxicity to Daphnia magna. The results demonstrated that (1) the neutral fraction was the most toxic; (2) the acid and neutral fractions contributed the most toxicity, 51.3 and 41.9 percent, respectively, to the toxicity of the whole effluent; (3) the toxicities of the four fractions were additive; and (4) the fractionation process did not significantly alter the toxicity of the effluent. Possible applications of this approach, as well as its limitations, are discussed. (Deal-EIS)
W80-00829

A CHRONIC TOXICITY TEST WITH THE MARINE COPEPOD ACARTIA TONSA,
United States Testing Co., Inc., Hoboken, NJ.
T. J. Ward, E. D. Rider, and D. A. Drozdowski.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 148-158, 1979. 3 Fig, 4 Tab, 13 Ref.

Descriptors: *Bioassay, *Copepods, *Life cycles, Methodology, Zooplankton, Growth stages, Animal physiology, Reproduction, Toxicity, Chemical wastes, Productivity, Laboratory test, Marine zooplankton, Crustaceans, *Acartia.

A chronic toxicity test was developed for studying the effects of five toxicants (effluents) on the survival and reproduction of Acartia tonsa, a marine zooplankton. The test involves the exposure of copepods to three concentrations of each material (320, 100, and 32 ppm) for an entire life cycle. It is divided into three parts: (1) the reproduction of laboratory-cultured A. tonsa in breeding chambers containing the three concentrations of toxicants under static conditions; (2) sexual maturation of the F1 organisms in the toxicant concentrations under flow-through conditions; and (3) the reproduction of the F1 organisms under the same conditions as those established for Part 1, and the monitoring of the organisms' reproductive success, defined as the number of viable F2 offspring. The results of the chronic tests were compared with data from an acute study conducted earlier. The chronic tests showed a significant reduction in organism survival, when compared with the acute tests (in the range of 1.0 to 0.1 percent of the 48-h LC50 value). This paper highlights the relative simplicity of the chronic A. tonsa test procedure and demonstrates its twofold usefulness: (1) in the identification of a long-term effect and (2) in the comparison of the chronic toxicity of differing materials. (Deal-EIS)
W80-00830

USE OF THE GRASS SHRIMP (PALAEMONETES PUGIO) IN A LIFE-CYCLE TOXICITY TEST,
Environmental Research Lab., Gulf Breeze, FL.
D. B. Tyler-Schroeder
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 159-170, 1979. 2 Fig, 3 Tab, 25 Ref.

Descriptors: *Shrimp, *Bioassay, *Pesticide toxicity, Methodology, Growth stages, Chlorinated hydrocarbon pesticides, Endrin, Larval growth stage, Life cycles, Reproduction, Juvenile growth stage, Animal physiology, *MATC.

A methodology for using the estuarine grass shrimp in life-cycle toxicity tests was successfully developed. Life-cycle exposures of juvenile shrimp to the chlorinated hydrocarbon pesticide endrin were begun in November 1976 and completed in March 1977. After the juveniles matured and spawned, the effects on their progeny were determined. The average measured exposure concentrations were 0 (control), 0.03, 0.05, 0.11, 0.18, 0.38, and 0.79 micrograms endrin/litre seawater. The juveniles reached sexual maturity during the first two weeks of the exposure. Thereafter, a photoperiod regime was used to induce reproduction, and the effects of endrin on the survival, growth, and reproduction of the parent generation were determined. Larvae spawned by control and exposed parents were continuously exposed until the juvenile state. The effects on survival, length of larval development, and growth of the F1 generation were determined. The 96-h LC50 for juvenile grass shrimp was 0.35 micrograms endrin/litre water. In the life-cycle toxicity test, gonadal development and spawning were inhibited at 0.03 micrograms endrin/litre water. Because this was the lowest concentration tested, the maximum allowable toxicant concentration could not be determined. The specific application factor for grass shrimp is, therefore, less than 0.08, approximately one order of magnitude lower than those generated in life-cycle tests exposing freshwater and estuarine fishes to endrin. (Deal-EIS)
W80-00831

A METHOD FOR MEASURING ALGAL TOXICITY AND ITS APPLICATION TO THE SAFETY ASSESSMENT OF NEW CHEMICALS,
Proctor and Gamble Co., Cincinnati, OH. Environmental Safety Dept.
A. G. Payne, and R. H. Hall.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 171-180, 1979. 4 Fig, 7 Ref.

Descriptors: *Analytical techniques, *Algae, *Bioassay, Monitoring, Methodology, Chemical properties, Growth rates, Toxicity, Algicides, Chlorophyta, Cyanophyta, Diatoms, Dinoflagellates, Surfactants, Productivity.

An algal toxicity test has been developed specifically for use in the environmental safety assessment of new chemicals. The test is based on the Algal Assay Procedure (Bottle Test) but has been

modified in order to make the procedure useful for toxicity assessment. A five-day exposure of freshwater or marine uni-algal cultures to a range of test material concentrations is followed by a nine-day recovery period in the absence of the test material. Cell counts or in vivo fluorescence measurements made during the study allow the quantification of toxic responses ranging from reduced growth, through the algistatic response, to the algicidal response. The primary toxicity effect sought in this method is the algistatic response, which is both easily determined and environmentally meaningful. The algistatic concentration of a test material, as derived by this method, is the concentration that causes no net change in cell number after chronic exposure but permits regrowth when the cells are resuspended in fresh media without the test material. The environmental significance of this type of measurement relative to other measurements of algal toxicity is discussed. (Deal-EIS)
W80-00832

UPTAKE, DEPURATION, AND TOXICITY OF HEXAMETHYLPHOSPHORAMIDE IN AQUATIC ORGANISMS,
Haskell Lab. for Toxicology and Industrial Medicine, Newark, DE.
P. W. Schneider, Jr., J. R. Gibson, G. C. Cramm, and S. P. Shrivastava.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 181-192, 1979. 1 Fig, 5 Tab, 17 Ref.

Descriptors: *Toxicity, *Bioassay, *Organic compounds, Industrial wastes, Chemical wastes, Daphnia, Sunfishes, Oysters, Minnows, Chemical analysis, Absorption, Mortality, Path of pollutants, Animal metabolism, *Tissue analysis, *Bioaccumulation, *Carcinogens, *Hexamethylphosphoramide, *Depuration.

Aquatic toxicity tests were undertaken to evaluate the environmental significance of hexamethylphosphoramide (HMPA). Hexamethylphosphoramide's 48-h LC50 to Daphnia and 96-h LC50 to bluegill sunfish were 4220 mg/litre and 7420 mg/litre, respectively. In concentrations up to and including 5140 mg/litre, HMPA did not interfere with the normal development of Eastern oyster embryos to the veliger stage. Both sheepshead minnows and Eastern oysters developed concentrations of HMPA in their tissues rapidly from 0.5, 8.4, and 40.4 mg/litre treatments, with the plateau concentrations rarely exceeding the exposure concentrations. Whole-body residues peaked in about three to seven days after the initiation of exposure. Sheepshead minnows demonstrated a greater ability to metabolize HMPA than oysters, while oysters depurated HMPA and its metabolites more rapidly than fish. Both species largely eliminated HMPA and its metabolites within one day of depuration. The bioconcentration factors for fish and oysters were less than four, which suggests that HMPA does not pose a substantial environmental hazard from the standpoint of its accumulation in aquatic organisms. The oyster mortality in the 8.4 and 40.4 mg/litre treatments was similar among all the treatments and the control. (Deal-EIS)
W80-00833

CONCENTRATION OF ELEMENTS IN MARINE ORGANISMS CULTURED IN SEAWATER FLOWING THROUGH COAL-FLY ASH,
Woods Hole Oceanographic Institution, MA.
J. Ryther, T. M. Losordo, A. K. Furr, T. Parkinson, and W. Gutenman.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 207-210, 1979. 2 Tab, 21 Ref.

Descriptors: *Water chemistry, *Industrial wastes, *Path of pollutants, Chemical analysis, Trace elements, Clams, Oysters, Worms, Coals, Electric powerplants, Aluminum, Bromine, Calcium, Cobalt, Iron, Magnesium, Zinc, *Arsenic, *Fly ash, *Tissue analysis, *Bioaccumulation, *Selenium.

Fly ash has been studied as a material to add to lakes to decrease the phosphorus concentration by fixation and thereby hopefully limit algal growth. In the work reported, marine organisms were cultured in seawater flowing through a bed of coal fly ash. The organisms were then analyzed for 40 elements by neutron activation and other methods. The organisms cultured and studied were: soft shell clams (Mya arenaria), hard shell clams (Mercenaria mercenaria), American oysters (Crassostrea virginica) and sand worms (Nereis virens). Values for elemental concentrations in fly ash and marine organisms were presented. Of the 40 elements studied, arsenic and selenium were of most concern because of their relative toxicity. (Deal-EIS)
W80-00834

DISTRIBUTION OF BENTHOS IN RELATION TO THE SULFIDE-CONTENT IN THE BOTTOM SEDIMENTS OF MIXO-POLYHALINE LAKE NOTORO, HOKKAIDO,
Hokkaido Univ., Hako-date (Japan). Lab. of Marine Culture.
S. Nakao.
Bulletin of the Faculty of Fisheries of Hokkaido University, Vol 29, No 3, p 199-212, 1978. 12 Fig, 3 Tab, 23 Ref.

Descriptors: *Dredging, *Sulfides, *Benthic fauna, Biological communities, Dissolved oxygen, Sea water, Bottom sediments, Water chemistry, Channel improvement, Invertebrates, Seasonal, Water temperature, Chlorination, *Polychaetes, *Species diversity.

Changes are described in the macrobenthic fauna in Lake Notoro in response to the enrichment of dissolved oxygen of bottom water and the diminution of total sulfide content in the bottom sediments, brought about by quantities of the inflow from outer sea water through an artificially constructed mouth. The dredging and enlarging of the outlet resulted in a better aeration of deeper water at all seasons and a wider distribution of benthic animals. The total sulfide content in the bottom sediments where no benthos had been found before this artificial construction decreased rapidly. In deeper water of better aeration the benthic community, though showing a low diversity value, was newly found in the bottom with such high content as 4.27 ppt in total sulfide. The index values of benthic communities increased with decreasing total sulfide content and showed a rapid rate of increase in total sulfide amount smaller than 1 ppt. (Deal-EIS)
W80-00835

ACUTE TOXICITY OF VANADIUM TO TWO SPECIES OF FRESHWATER FISH,
University of Southern California, Los Angeles. Dept. of Biological Sciences.
B. K. Knudtson.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 95-99, 1979. 1 Tab, 11 Ref.

Descriptors: *Toxicity, *Bioassay, Fish physiology, Trace elements, Mortality, *Freshwater fish, Lethal limit, Ammonium compounds, Sodium compounds, Metals, Chemical properties, *Vanadium, *Vanadium compounds, Goldfish, Guppies, Carassius, Lebistes.

Static bioassays for acute vanadium toxicity were performed using goldfish (Carassius auratus) and guppies (Lebistes reticulatus). Sodium metavanadate, ammonium metavanadate, vanadyl sulfate, and vanadium pentoxide were tested separately. 144-h LC50 values for C. auratus were 2.45, 3.82, 2.95 and 8.08 ppm, respectively. Similarly, L. reticulatus values were 0.49, 1.49, 0.37 and 1.05 ppm. In general, these results indicate that, with the possible exception of ammonium metavanadate, there is an obvious differential sensitivity to vanadium compounds between the two species. In addition, they suggest that intraspecific sensitivity to the various compounds is substantially less than interspecific sensitivity. (Deal-EIS)
W80-00836

TOXICITY OF FOUR SYNTHETIC PYRETHROID INSECTICIDES TO RAINBOW TROUT,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
J. R. Coats, and N. L. O'Donnell-Jeffery.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 250-255, 1979. 1 Fig, 2 Tab, 18 Ref.

Descriptors: *Pesticide toxicity, *Rainbow trout, Insecticides, Mortality, Mosquitoes, Fish physiology, Fry, Chemical properties, Organic pesticides, Bioassay, Toxicity, *Pyrethroid pesticides, *Permethrin, *Cypermethrin, *Fenvalerate, *Fenpropanate.

Synthetic pyrethroids constitute a new group of very potent insecticides. Fish toxicity is of particular concern in view of the potential use of these insecticides in aquatic habitats as they have demonstrated excellent activity against mosquito larvae. The current investigation assesses the toxicity of 4 experimental photostable pyrethroids to fingerling rainbow trout. The LC50 values for permethin, cypermethin, fenvalerate and fenpropanate were 135, 55, 76 and 76.7 ppb, respectively, for the technical grade product and 61, 11, 21 and 8.6 ppb for the formulated product. (Deal-EIS)
W80-00837

EMBRYOTOXIC EFFECTS OF CRUDE OIL CONTAINING NICKEL AND VANADIUM IN MALLARDS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
D. J. Hoffman.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 203-206, 1979. 1 Tab, 12 Ref.

Descriptors: *Nickel, *Oil, *Toxicity, *Mallard ducks, Embryonic growth stage, Bird eggs, Oil pollution, Growth rates, Mortality, Animal physiology, *Vanadium, *Crude oil.

The addition of relatively high concentrations of vanadium or nickel porphyrin compounds to a crude oil that only contained trace amounts of vanadium and nickel did not significantly increase mallard embryonic mortality above the level caused by the crude oil alone. However, embryonic mortality appeared slightly greater in the presence of vanadium or nickel and it is possible that this effect might be amplified with a lower dose of oil. The temporal pattern of embryonic mortality did not differ in the presence of added vanadium or nickel. (Deal-EIS)
W80-00838

EVIDENCE FOR THE PROTECTIVE EFFECT OF METALLOTHIONEINS AGAINST INORGANIC MERCURY INJURIES TO FISH,
Liege Univ. (Belgium). Lab. d'Oceanogolie.
J. M. Bouquegneau.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 218-219, 1979. 1 Fig, 5 Ref.

Descriptors: *Mercury, *Toxicity, *Eels, Animal metabolism, Animal physiology, Mortality, Inhibition, *Cadmium, Heavy metals, Sea water, Water chemistry, *Metallothioneins.

In order to test the hypothesis of a protective role of metallothioneins, we have compared the toxicity of a lethal dose of mercury (10 ppm) on sea water adapted eels using animals whose gills contained or did not contain metallothioneins, depending on the treatment to which they had been submitted. A preintoxication with a sublethal dose of HgCl2, which induces the synthesis of metallothioneins in the gills, reduces the toxicity of the lethal dose of 10 ppm. That dose is even less toxic when the eels have been preintoxicated by a sublethal dose of CdCl2. In this case, CdCl2 induces the synthesis of metallothioneins in eel's gills which bind all the cadmium present in the tissue. (Deal-EIS)
W80-00839

ENVIRONMENTAL BROMINE IN FRESHWATER AND FRESHWATER ORGANISMS: FACTORS AFFECTING BIOACCUMULATION,

Middle Tennessee State Univ., Murfreesboro. Dept. of Chemistry and Physics.
A. E. Woods, R. F. Carlton, M. E. Casto, and G. I. Gleason.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 179-185, 1979. 3 Fig, 2 Tab, 5 Ref.

Descriptors: *Bromine, *Sewage effluents, Fishkills, Path of pollutants, Crayfish, Freshwater fish, Chemical analysis, Wastewater treatment, Chlorine, Chlorination, Sunfishes, Toxicity, Mortality, *Tissue analysis, *Bioaccumulation.

While studying fishkills it was noted that bromine levels in organisms varied greatly in the study area. Samples taken from above a municipal sewage outlet were relatively high in bromide while those immediately below had negligible bromide levels. It was concluded that the depletion of bromide was due to the addition of chlorine to the wastewater effluent. This created an oxidizing environment which inhibited bromine bioaccumulation. (Deal-EIS)
W80-00840

IDENTIFICATION OF THE HERBICIDE 2,4,6-TRICHLOROPHENYL P4-NITROPHENYL ETHER IN IMPORTED RAINBOW TROUT,
Food and Drug Administration, Brooklyn, NY.
F. M. Gretch, T. L. Barry, G. Petzinger, and J. Geltman.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 165-169, 1979. 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Pesticide residues, *Rainbow trout, *Pollutant identification, Path of pollutants, Chlorinated hydrocarbon pesticides, Herbicides, Pesticide kinetics, Chemical properties, Chemical analysis, Gas chromatography, Analytical techniques, *Tissue analysis, *2,4,6-trichlorophenyl-p-nitrophenyl ether, Japan.

A sample of frozen rainbow trout imported from Japan was examined for pesticide residues. The trout was found to contain an unknown compound. Low resolution gc-ms analysis of the sample extract was used to determine that the molecular weight of the unknown compound was 317, that it contained three chlorine atoms and that it contained an odd number of nitrogen atoms. The fragmentation pattern was similar to that of the herbicide nitrogen (2,4-dichlorophenyl-p-nitrophenyl ether), C12H7Cl2NO3, suggesting a similar structure. The unknown component was tentatively identified as a trichloro-nitro-phenyl ether (C12H6Cl3NO3). The structure of the unknown was confirmed by obtaining accurate mass measurements and elemental composition data using double beam gc-ms. A search of the literature led to references on a relatively new herbicide, 2,4,6-trichloro-phenyl-p-nitrophenyl ether, tradenamed MOR. A reference standard of this compound was obtained from the manufacturer, and the identity of the unknown component in the sample was confirmed by retention time and mass spectral data. (Deal-EIS)
W80-00841

ACUTE ENDRIN TOXICITY ON OXIDASES OF OPHIOCEPHALUS PUNCTATUS (BLOCH),
Hindu Coll., Moradabad (India). Dept. of Zoology.
S. K. Sharma, L. D. Chaturved, and K. V. Sastry.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 153-157, 1979. 2 Tab, 14 Ref.

Descriptors: *Pesticide toxicity, *Endrin, *Enzymes, *Inhibition, Fish physiology, Toxicity, Mortality, Animal metabolism, Biochemistry, Chemical analysis, Mode of action, Chlorinated hydrocarbon pesticides, *Tissue analysis.

The acute effects of endrin on enzyme activities was studied in Ophiocephalus punctatus. Exposure to five different endrin concentrations for 96-h was found to decrease the activity of succinic, pyruvic and lactic dehydrogenases in liver and kidney. The diminished enzyme activities may be due either to decreased synthesis of enzymes in the tissues or to damage of cytoplasmic organelles. (Deal-EIS)
W80-00842

DISTRIBUTION OF RADIOACTIVITY IN COALFISH (POLLACHIUS VIRENS) FOLLOWING INTRAGASTRIC ADMINISTRATION OF (9-14C) PHENANTHRENE,
Bergen Univ. (Norway). Inst. of Fisheries Biology.
J. E. Solbakken, K. H. Palmork, T. Neppelberg, and R. R. Scheline.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 100-103, 1979. 1 Tab, 6 Ref.

Descriptors: *Path of pollutants, *Tracers, *Organic compounds, Radiochemical analysis, Carbon radioisotopes, Fish physiology, Animal metabolism, Aromatic compounds, Chemical properties, Biochemistry, *Coalfish, *Crude oil, *Phenanthrene, *Tissue analysis, *Liver, *Gall bladder.

The distribution of radioactively-labelled phenanthrene was studied at various time intervals following intragastric injection. Samples of liver, gall bladder and white muscle were analyzed from each fish. The liver showed by far the greatest degree of accumulation of radioactivity. Maximum accumulation occurred from 10 to 24 h after dosing and nearly 72% of the dose was present in this organ after 17 h. Large amounts of radioactivity were also found in the gall bladder and, not surprisingly, the highest values were recorded at somewhat later times (24-48 h). The gall bladder values remained fairly high until 96 h, a finding which is no doubt related to the fact that the fish were fasted until this time. The nature of the biliary and urinary metabolites in the present study will be dealt with in a subsequent publication. (Deal-EIS)
W80-00844

VARIABILITY OF THE CONCENTRATIONS OF SEVENTEEN TRACE ELEMENTS IN THE MUSCLE AND LIVER OF A SINGLE STRIPED BASS, MORONE SAXATILIS,
Department of Energy, New York. Environmental Measurement Lab.
M. Heit.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 1-5, 1979. 1 Tab, 8 Ref.

Descriptors: *Trace elements, *Path of pollutants, *Bass, *Cadmium, *Copper, *Mercury, *Nickel, *Lead, *Zinc, Heavy metals, Fish physiology, Chemical analysis, Spectrophotometry, *Silver, *Arsenic, *Selenium, *Tellurium, *Tissue analysis.

During the study of a number of trace elements in striped bass it was noted that their distribution was not homogeneous. A comparison of the average element concentrations in the muscle with those found in both lobes of the liver indicated that the levels of Ag, As, Cd, Hg, Ni, Pb, Se, Te, and Zn were significantly higher ($p < or = 0.10$) in the liver than in the muscle. Only Cd, Hg and Se were significantly higher ($p < or = 0.10$) in concentration in the larger liver lobe as compared to the smaller lobe. These results are not unexpected in that a number of marine and freshwater species have been reported to have higher concentrations of trace elements in their liver than in their muscle tissue. (Deal-EIS)
W80-00846

DETERMINATION METHOD FOR RESIDUAL 1,3-DICHLORO-AND 1,3,5-TRICHLORO-2-(4-NITROPHENOXY) BENZENE (NIP AND CNP) IN FISH AND SHELLFISH,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
T. Yamagishi, K. Akiyama, M. Morita, R. Takahashi, and T. Miyazaki.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 57-63, 1979. 3 Fig, 12 Ref.

Descriptors: *Pesticide residues, *Analaytical techniques, *Gas chromatography, Methodology, Chemical analysis, Chlorinated hydrocarbon pesticides, Pollutant identification, DDT, Polychlorinated biphenyls, Chemical properties, Clams, Herbicides, *Tissue analysis, *CNP, *NIP.

An electron capture gas chromatography technique is proposed for the detection of the pesticides NIP and CNP in fish and shellfish. This method can remove other contaminating organochlorine compounds such as PCBs and DDTs. The method involves homogenization of specimens, extraction by solvents, clean-up through saponification and chromatography on a Florisil column before gas chromatography. DDTs can be eliminated effectively by the saponification and PCBs by the Florisil chromatography. Results from fish and clam tissue were consistent in triplicated runs. Sensitivities of the method were 0.5 and 0.3 ppb for CNP and NIP, respectively. (Deal-EIS)
W80-00847

ORGANOCHLORINE RESIDUES IN EGGS OF THE ENDANGERED AMERICAN CROCODILE (CROCODYLUS ACUTUS),
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
R. J. Hall, T. E. Kaiser, W. B. Robertson, Jr., and P. C. Patty.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 87-90, 1979. 2 Tab, 6 Ref.

Descriptors: *Pesticide residues, *Reptiles, *Chlorinated hydrocarbon pesticides, DDE, DDD, DDT, Dieldrin, Heptachlor, Polychlorinated biphenyls, Chemical analysis, Pesticide kinetics, *Chlordane, *Nonachlor, *Mirex, *Tissue analysis, *Bioaccumulation, *Crocodiles, *Toxaphene.

Eggs from eight clutches which failed to hatch were analysed for organochlorine residues. The eggs contained a variety of organochlorine contaminants. DDE, DDT, and PCBs were detected in all eight clutches. DDD, dieldrin, and metabolites of chlordane were each detected in seven clutches. Heptachlor epoxide was present at detectable levels in five clutches and mirex was found in four clutches. Endrin, toxaphene, and HCB were not detected. Mean residues were highest for DDE (1.2 ppm) and PCB (0.54 ppm) and were less than 0.1 ppm for all other contaminants. (Deal-EIS)
W80-00848

ABERRATIONS IN THE NEUROSECRETORY CELLS OF A FRESHWATER PULMONATE, INDOPLANORBIS EXUSTUS, CHRONICALLY EXPOSED TO SUBLETHAL CONCENTRATION OF TWO MOLLUSCICIDES, BACL2 AND CUSO4,
Marathwada Univ., Aurangabad (India). Dept. of Zoology.
M. M. Hanumante, R. Nagabhushanam, and D. P. Vaidya.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 70-72, 1979. 1 Tab, 14 Ref.

Descriptors: *Pesticide toxicity, *Snail, *Cytological studies, Barium compounds, Copper sulfate, Toxicity, Animal physiology, Bioassay, Chemical properties, Chemical analysis, *Tissue analysis, *Histology.

Adults of Indoplanorbis exustus were exposed to concentrations of either 1.0 ppm BaCl2 or 0.1 ppm CuSO4 for seven days. Following exposure the central nervous systems of the snails were fixed and analysed. The CNS of I. exustus contains two types of NSC, A and B. Both the cells from cerebral, pleural, parietal and visceral ganglia revealed histopathological aberrations after 7 days of exposure. A significant ($P = 0.05$) increase was evident in nuclear diameters of A and B cells without significant change in their cell dimensions. Both the molluscicides provoked striking declines in the neurosecretory material intensity from A and B cell perikarya. Their neurohaemal areas also showed depletion of neurosecretory material. Both the cell perikarya were laden with large number of vacuoles only after CuSO4 treatment. (Deal-EIS)
W80-00849

FATE OF 14C-CIS-CHLORDANE IN GOLDFISH, CARASSIUS AURATUS (L.),
Illinois Univ. at the Medical Center, Chicago.

Dept. of Biological Sciences.
M. Feroz, and M. A. Q. Khan.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 64-69, 1979. 2 Fig, 1 Tab, 21 Ref.

Descriptors: *Radioactivity techniques, *Pesticide kinetics, Tracers, Carbon radioisotopes, Radiochemical analysis, Pesticide residues, Fish physiology, Path of pollutants, Chlorinated hydrocarbon pesticides, Water chemistry, *Chlordane, *Tissue analysis, *Bioaccumulation, *Goldfish, *Carassius.

Goldfish were exposed to 25.94 ppb radioactively labeled chlordane for 24-h and then maintained for 25 days. At the termination of the experiment the fish were analysed for radioactivity. It was found that over 99% of the radioactivity recovered from the fish was unchanged cis-chlordane, indicating its inert storage in body tissues. It was also observed that absorption of labeled chlordane was quite rapid, most occurring during the first 24-h. (Deal-EIS)
W80-00850

EFFECTS OF IN VIVO CADMIUM EXPOSURE ON ATPASSES IN GILL OF THE LOBSTER, HOMARUS AMERICANUS,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
R. K. Tucker.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 33-35, 1979. 1 Tab, 10 Ref.

Descriptors: *Cadmium, *Lobsters, *Toxicity, *Enzymes, Chemical analysis, Path of pollutants, Inhibition, Biochemistry, Animal physiology, Heavy metals, Crabs, Crustaceans, *Tissue analysis, *Bioaccumulation.

Gill homogenates from lobsters exposed to 6 ppb cadmium for 30 days showed an almost 25% increase in ouabain-insensitive ATPase activity. No difference in Na+K+ATPase, however, was apparent between control and cadmium-exposed animals. This latter enzyme is inhibited by ouabain and thus distinguishable in our assay system. Previous in vitro studies of ATPase activity in gill homogenates of the rock crab, C. irroratus, indicate that 10 ppm Cd when added to the assay incubation mixture, inhibited the Na+K+ATPase by almost 40% and also had a slight inhibitory effect on the remaining (ouabain-insensitive) ATPase activity. Although the in vitro cadmium concentration, 10 ppm, to which the rock crab enzymes were exposed, was much higher than the 6 ppb Cd in vivo exposure for the lobsters, the tissue metal levels were much less disparate because of the ability of the living animals to take up metal. (Deal-EIS)
W80-00851

HEXACHLOROBENZENE (HCB) LEVELS IN LAKE ONTARIO SALMONIDS,
Canada Centre for Inland Waters Burlington (Ontario).
A. J. Niimi.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 20-24, 1979. 1 Fig, 3 Tab, 17 Ref.

Descriptors: *Pesticide residues, *Salmonids, *Lake Ontario, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Path of pollutants, Persistence, Great lakes, Pollutant identification, Chemical analysis, Lake trout, Rainbow trout, Coho salmon, Lipids, *HCB, *Tissue analysis, *Bioaccumulation.

This study examined the levels of HCB in lake trout, rainbow trout, and coho salmon from Lake Ontario to confirm the bioaccumulative property of this compound in a natural water body, and to evaluate its potential impact as an important environmental contaminant. HCB levels in whole fish homogenates averaged 80 nannogram/g for lake trout, 62 nannogram/g for rainbow trout, and 36 nannogram/g for coho salmon. The levels of HCB increased significantly with body weight for all species. For fish of the same weight, HCB levels were highest in lake trout, followed by rainbow trout, and coho salmon. Mean HCB levels in fat were estimated to be 0.5 microg/g for lake trout, 0.7 microg/g for rainbow trout, and 0.5 microg/g for coho salmon. To put the significance of these levels into perspective, the United States Environmental Protection Agency has recommended an interim action guideline of 0.5 microg/g in the fat of domestic animals, and the Food and Drug Administration has adopted a guideline of 0.3 microg/g in the fat of mild and dairy products. (Deal-EIS)
W80-00852

ALKANES IN BARNACLES (BALANUS TINTINNABULUM) FROM THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
B. S. Middleditch, E. S. Chang, and B. Basile.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 6-12, 1979. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Aromatic compounds, *Absorption, *Oil, Crustaceans, Offshore platforms, Water chemistry, Chemical analysis, Animal physiology, Path of pollutants, Oil pollution, Texas, Gulf of Mexico, Buccaneer oilfield, *Barnacles, *Balanus, *Tissue analysis, *Bioaccumulation, *Depuration.

The uptake and discharge of petroleum hydrocarbons by barnacles on offshore drilling platforms was studied. Results indicate that barnacles growing near the surface ingest oil-derived alkanes when the oil concentration in the water was relatively high. When the alkane concentration in the water is reduced, however, the ingested alkanes may be excreted. Shells from specimens collected both at the surface and below all contain petroleum-like alkanes although it is possible that such compounds derive from organisms attached to the shells. Further work is required to determine whether this assumption is correct. It is generally considered that petroleum hydrocarbons are not concentrated during passage through food webs. Since these compounds are present at higher concentrations in flesh from some barnacles than in the surrounding water, it would be of interest to determine the hydrocarbon content of fish which graze on the barnacles. (Deal-EIS)
W80-00853

PARATHION CAUSES SECONDARY POISONING IN A LAUGHING GULL BREEDING COLONY,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
D. H. White, K. A. King, C. A. Mitchell, E. F. Hill, and T. G. Lamont.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 281-284, 1979. 2 Fig, 8 Ref.

Descriptors: *Pesticide toxicity, *Gulls, *Mortality, Growth stages, Organophosphorus pesticides, Mode of Action, Path of pollutants, Insects, Pesticide kinetics, Chemical analysis, *Parathion, *Tissue analysis, Texas, Nueces Bay.

In the spring of 1978, during the course of a study of the reproductive success of several aquatic bird species, 116 dead laughing gull chicks and dead adults were found. Shortly thereafter a second mass mortality of over 100 adults was discovered. Investigation revealed that a local cotton field had recently been sprayed with parathion, an organophosphate pesticide. Analysis of stomach contents of dead gulls revealed the presence of large quantities of insects and between 0.02 and 10 ppm parathion. Brain tissue analysis demonstrated inhibited acetylcholinesterase activity, a sign of organophosphate pesticide toxicity. This is thought to be the first recordd instance of an organophosphate insecticide killing by means of insects carried to the young. (Deal-EIS)
W80-00854

IN VITRO TOXICITY OF EIGHT MUTAGENS/CARCINOGENS FOR THREE FISH CELL LINES,
Washington Univ., Seattle. Dept. of Pathology.
R. M. Kocan, M. L. Landolt, and K. M. Sabo.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 269-274, 1979. 1 Fig, 11 Ref.

Descriptors: *Toxicity, *Chemical properties, *Cytological studies, Organic compounds, Rainbow trout, Sunfishes, Fish physiology, Growth rates, Analytical techniques, Chemical analysis, Mode of action, *Mutagens, *Carcinogens.

Numerous techniques involving whole animal testing for cancer, cell culture for mutation and cytogenetic changes and bacterial mutagenicity have been devised to assay specific chemicals and inspect unknown mixtures. Little, however, has been done to determine the effects of foreign chemicals on aquatic organisms due to the difficulty of maintaining these animals in the laboratory. To circumvent some of these problems and still determine whether various chemical agents affect aquatic animals, we have explored the use of fish cell culture for initial screening. Established fibroblast cell lines from three species of fish were used for the toxicity studies, with human fibroblast cultures serving as positive controls. Eight known mutagens/carcinogens were analysed for toxic effects on the cell cultures. Two distinct responses to the mutagens were observed. In one, the number of cells continued to decline in direct proportion to the amount of chemical in the media. This represents increasing toxicity as the concentration of mutagen increases. The second response was one of an initial reduction in cell number below the controls but no further decrease in cell number as the mutagen concentrations increased. This response was the result of treated cells not dividing, while the untreated controls continued to replicate. (Deal-EIS)
W80-00855

OCCURRENCE OF PCB RESIDUES IN BURBOT (LOTA LOTA) AND LAKE TROUT (SALVELINUS NAMAYCUSH) FROM THE CHURCHILL FALLS POWER DEVELOPMENT AREA,
Department of Fisheries and Environment, Halifax (Nova Scotia).
C. J. Musial, J. F. Uthe, R. J. Wiseman, and R. A. Matheson.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 256-261, 1979. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *Polychlorinated biphenyls, *Aroclors, *Lake trout, Chemical analysis, Gas chromatography, Path of pollutants, Water pollution sources, Powerplants, Water chemistry, Canada, Chemical wastes, Churchill Falls, *Burbot, *Tissue analysis, Hydroelectric power.

Fish taken above and below the Churchill Falls hydroelectric project (Canada) were analysed for PCB residues using the gas chromatography technique. The PCB patterns obtained from the fish taken at sampling sites upstream of the Churchill Falls generating station were most closely matched by mixtures of Aroclors 1254 and 1260 in ratios ranging from approximately 2:1 to 1:1 1254:1260. These results are consistent with the ratios of 1254 to 1260 found in marine fish such as cod from the offshore fishing grounds in the general area of the east coast of Canada. However, the pattern obtained from fish taken just below the Churchill Falls power plant (the 'tail race'), was most closely matched by Aroclor 1260 solely, with depression of certain penta-and hexachlorobiphenyl peaks and two of the octachlorobiphenyl peaks. This is interesting in view of the fact that 1254 is the principal mixture used in these hydroelectric power installations and may reflect an unusual degree of volatilization of the lower molecular weight components of Aroclor 1254 or an adsorption or other type of reaction which would result in removal or unavailability of these components for uptake by the fish. The total quantity of PCB being released into the river cannot be calculated at present because the levels in the water and sediments have not been determined. However, the high levels in the tail race fish indicate an important source of PCB contamination in the Churchill Falls area. (Deal-EIS)
W80-00856

TOTAL RESIDUAL CHLORINE: THE EFFECT OF SHORT-TERM EXPOSURE ON THE EM-

ERALD SHINER NOTROPIS ATHERINOIDES (RAFINESQUE),
Minnesota Pollution Control Agency, Roseville.
G. Fandrei, and H. L. Collins.
Bulletin of Environmental Contamination and Toxicology, Vol. 23, p 262-268, 1979. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Chlorine, *Toxicity, *Shiners, Bioassay, Chlorination, Mortality, Fish physiology, Water temperature, Antifouling materials, Growth stages.

The effects of short-term chlorine exposure, as occurs in antifouling operations associated with cooling systems, were studied at 10 and 25C. Three age categories (adults, yearlings and young-of-the-year) were employed. Total residual chlorine (TRC) toxicity was significantly different at the two temperatures, the fish being approximately three times more sensitive at the higher temperature. The difference in sensitivity to TRC between the age groups was statistically insignificant, young-of-the-year being slightly more resistant. (Deal-EIS)
W80-00857

TOXICITY AND TISSUE UPTAKE OF METHYLMERCURY ADMINISTERED INTRAPERITONEALLY TO RAINBOW TROUT (SALMO GAIRDNERI RICHARDSON),
Alberta Univ., Edmonton. Dept. of Zoology.
C. W. Hawryshyn, and W. C. Mackay.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 79-86, 1979. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Mercury, *Absorption, *Rainbow trout, Fish physiology, Animal metabolism, Path of pollutants, Heavy metals, Toxicity, Mortality, Lethal limit, Organic compounds, *Methylmercury, *Tissue analysis, *Bioaccumulation.

The objective was to determine the 15 day LD50 for a single intraperitoneal dose of methylmercury (MMC) and secondly to measure the concentration (tissue uptake) of Hg in the brain, eye, and epaxial musculature 30 days following an injection of different sublethal doses of MMC. The 15 day LD50 for a single intraperitoneal injection in rainbow trout is 5.7 plus or minus 0.4 mg Hg per kg of body weight, determined by interpolation. The mean uptake (body burden) for this was 5.1 plus or minus 0.6 microgram Hg per g of body tissue indicating that the fish accumulated approximately 90% of the dose administered. A one way analysis of variance indicated a significant difference between the mercury content of the three tissues tested (brain > muscle > eye) (all $P < 0.001$) for each dose level. The concentration of mercury in each tissue increased significantly ($P < 0.001$) with increasing sublethal dose of methylmercury. (Deal-EIS)
W80-00859

POLYCHLORINATED BIPHENYLS IN PLANKTON FROM THE TURKU ARCHIPELAGO,
Turku, Univ. (Finland). Dept. of Chemistry and Biochemistry.
R. R. Linko, P. Rantamaki, K. Rainio, and K. Urpo.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 145-152, 1979. 1 Fig, 3 Tab, 17 Ref.

Descriptors: *Polychlorinated biphenyls, *Plankton, Monitoring, Pollutant identification, Chemical wastes, Industrial wastes, Gas chromatography, Chemical analysis, Sampling, Lipids, Path of pollutants, *Finland, *Baltic Sea, Turku archipelago.

Plankton samples were collected during 1975-76 from the Turku archipelago (Finland). The samples were analysed for PCB content using gas chromatographic techniques. The 1974 samples contained an average of 38 ppm lipid weight or 0.37 ppm wet weight PCBs. The 1975-76 sample averages were 28 and 0.23 ppm, respectively. A large variation in PCB content was noted according to sample location and season. (Deal-EIS)
W80-00861

TUMOURS AND MICROBIAL DISEASES OF MARINE FISHES IN ALASKAN WATERS,
National Marine Fisheries Service, Seattle, WA. Environmental Conservation Div.
B. B. McCain, W. D. Gronlund, M. S. Myers, and S. R. Wellings.
Journal of Fish Diseases, Vol 2, p 111-130, 1979. 15 Fig, 1 Tab, 15 Ref.

Descriptors: *Fish diseases, *Demersal fish, *Alaska, Animal pathology, Fish populations, Pathogenic bacteria, Pseudomonas, Infection, Size, Length, Sampling, Oil, Oil spills, *Neoplasms, *Tissue analysis.

In an effort to further define the current health status of demersal fish in the Bering Sea, 36,618 fish captured by otter trawl during 1976 were examined for pathological conditions. Of the 26 species examined, 22 were found to have no detectable abnormalities. The four species with abnormalities were Pacific Cod Gadus macrocephalus Tilesius with pseudobranchial tumours and skin lesions, walleye pollock Theragra chalcogramma (Pallas) with lymphocystis, and rock sole Lepidopsetta bilineata (Ayres) with epidermal papillomas. The prevalence, geographical distribution and biological and pathological characteristics of affected individuals were determined. Two main types of skin lesions were seen on Pacific cod: ulcers and ring-shaped lesions. Isolates of bacteria (Pseudomonas sp.) were routinely obtained from the cod ulcers and may be the cause of this disease. The ring-shaped skin lesions, when examined microscopically, contained unidentified epidermal basophilic bodies. The study was conducted to evaluate the impact of oil exploration and production (Deal-EIS)
W80-00862

EFFECTS OF TERRITORIALITY ON OXYGEN CONSUMPTION IN TILAPIA NILOTICA,
Hokkaido Univ., Hakodate (Japan). Faculty of Fisheries.
S. Y. Mishrigi, and T. Kubo.
Bulletin of the Faculty of Fisheries of Hokkaido University, Vol 29, No 4, p 308-312, 1978. 2 Tab, 14 Ref.

Descriptors: *Fish behavior, *Tilapia, *Oxygen requirements, Fish physiology, Animal metabolism, Oxygen, Water chemistry, Growth rates, Weight, Growth stages, Size, *Territorial behavior.

The agressive behaviour associated with territoriality in Tilapia nilotica was found to elevate the oxygen consumed to meet routine metabolism energy requirements at 26C. This was traced for both small immature and large adult fish. On the other hand mature fish showed a decrease of about 50% in the oxygen consumed for specific dynamic action. This suggests an increase in the weight exponent and a decrease of the level of metabolism of the T-line equation. Also, there is a correlation between the available space to meet the territory requirements and hence the magnitude of the aggressive behaviour, and runting of tilapia under culture condition. (Deal-EIS)
W80-00863

SEPARATE AND JOINT TOXICITY TO RAINBOW TROUT OF SUBSTANCES USED IN DRILLING FLUIDS FOR OIL EXPLORATION,
Guelph, Univ. (Ontario). Dept. of Zoology.
J. B. Sprague, and W. J. Logan.
Environmental Pollution, Vol 19, p 269-281, 1979. 2 Fig, 2 Tab, 27 Ref.

Descriptors: *Toxicity, *Rainbow trout, *Surfactants, *Drilling fluids, Chemical properties, Chemical wastes, Fish physiology, Mortality, Lethal limit, Sorption, Bioassay, Alcohols, Organic compounds, Paraformaldehyde, Capryl alcohol, Bentonite, Barite.

Paraformaldehyde, capryl alcohol, and 5 surfactants were lethal to rainbow trout at less than 100 mg/litre. They were the most toxic of 21 tested materials likely to be present in used well-drilling fluids. Least toxic were bentonite, barite, and several organics. There was no consistent picture for joint action in mixtures. Used fluids were lethal at 0.71, 1.2 and 0.83 times the values predicted from an assumption of additive toxicity of approximated components. Those results were in statistical agreement with additivity. The LC50 of the simulated fluid was 1.5 times the value predicted from its seven components, significantly less-than-additive. When the seven most toxic components were added singly to simulated fluid, about half the results were not different from additive joint action. However, for every component plus fluid, there was antagonism in at least one of three proportions tested. Strongest antagonism was 3.7 times the predicted value for the surfactant B-Free added to fluid. Decreased toxicity may have resulted from sorption of components on bentonite, or different toxic mechanisms for fish. Six of the seven most toxic components lost toxicity upon ageing for 16 days in water, while B-Free increased sharply in toxicity. (Deal-EIS)
W80-00864

INFLUENCE OF SALINITY AND CADMIUM ON CAPSULE STRENGTH IN PACIFIC HERRING EGGS,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station
D F Alderdice, H Rosenthal, and F P J Velsen.
Helgolander wissenschaftlichen Meeresuntersuntersuchungen, Vol 32, p 149-162, 1979. 5 Fig, 1 Tab, 30 Ref.

Descriptors: *Cadmium, *Salinity, *Fish eggs, *Herrings, Toxicity, Fish reproduction, Fish physiology, Water chemistry, Calcium, Size, Growth rates, Mechanical properties, Strength.

Eggs of Pacific herring (Clupea pallasi) were incubated at 5C in salinities of 5, 20, and 35 ppt, and in cadmium concentrations of 0.05, 0.1, 1, 5, and 10 ppm (20 ppt S). Bursting pressures of eggs in the eight groups were measured throughout incubation. In general, bursting pressures rose to a primary maximum after fertilization, declined, rose to a secondary maximum, then declined again toward hatching. Rate of attainment of the primary maximum was related to salinity of the incubation medium. Bursting pressures at the primary and secondary maxima reached final values of about 1300 and 700 g, respectively, in incubation salinities at and above 20 ppt. Corresponding egg volumes were greatest in low salinities (5 ppt) and near minimum values in salinities of 20 ppt or greater (35 ppt). Cadmium in the incubation medium delayed attainment of primary maximum bursting pressures and primary and secondary maxima were reduced to 200-350 g at Cd concentrations near 1 ppm. Egg volumes also decreased with increased Cd concentration. It appears that Ca++/Cd++ ratios, depending on salinity and Cd levels in the incubation medium, influence the properties of both the jelly coat and the capsule of herring eggs. Changes in the properties of these layers could make the eggs more susceptible to mechanical damage, particularly at combinations of higher (approx or > 1 ppm) Cd concentration and lower (approx or < 20 ppt) salinities. (Deal-EIS)
W80-00865

INFLUENCE OF SALINITY AND CADMIUM ON THE VOLUME OF PACIFIC HERRING EGGS,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
D. F. Alderdice, H. Rosenthal, and F. P. J. Velsen.
Helgolander wissenschaftlichen Meeresuntersuntersuchungen, Vol 32, p 163-178, 1979. 5 Fig, 3 Tab, 35 Ref.

Descriptors: *Salinity, *Cadmium, *Toxicity, *Fish eggs, Growth stages, Volume, Water chemistry, Osmosis, Ion exchange, Biological membranes, Fish physiology, Fish reproduction, Fertilization, Herring, *Tissue analysis.

Changes in total volume and volume of the yolk and perivitelline space of Pacific herring eggs were examined throughout incubation at 5C in relation to salinity of the incubation medium (5, 20, 35 ppt S), and after exposure to cadmium (0.05-10 ppm

Cd) at 20 ppt S. After fertilization and filling of the perivitelline space there was a decline in total egg volume in all salinities until 60-80 hr after fertilization. There followed a period of relative stability of total volume (100-240 hr), then a slow decline until hatching (240-619 hr). There was an inverse relation between egg volume and salinity at all stages of egg development. Prior to 80 hr, changes in egg volume appeared primarily to be simple adjustments to prevailing osmotic and ionic conditions, modified, however, by presumed irreversible changes induced in the egg in relation to salinity experience at, and shortly after, fertilization. Subsequently, between 80-100 hr, egg volume appears to become regulated, commencing in the interval between late blastodermal overgrowth and blastopore closure. (Deal-EIS)
W80-00866

DDT AND ITS METABOLITES IN ANTARCTIC BIRDS,
Warsaw Univ. (Poland). Dept. of Zoology and Ecology.
A. B. Lukowski.
Polskie Archiwum Hydrobiologii, Vol 25, No 3, p 729-737, 1978. 1 Fig, 3 Tab, 13 Ref.

Descriptors: *DDT, *Path of pollutants, *Birds, *Pesticide residues, DDD, DDE, Chlorinated hydrocarbon pesticides, Insecticides, Gas chromatography, Chemical analysis, Food chains, Antarctic, Animal physiology, Food habits, *Tissue analysis, *Bioaccumulation, *Liver.

Contents of pp'DDE, pp'DDD and pp'DDT in the liver, muscle and adipose tissue of nine species of Antarctic birds were determined by gas chromatography. These birds originated from the regions of: Palmer Archipelago, Kinge Island and South Georgia Island, in February and March 1976. The tissue content of total DDT was highest in Catharacta skua from the Palmer Archipelago region. Maximum content of insecticides in the liver, muscle and adipose tissue was 1.5649, 1.5730 and 6.5916 ppm, respectively. Differences in the tissue contents of pp'DDT and its metabolites between birds of different species are most likely due to the dissimilarities in their food ration. (Deal-EIS)
W80-00867

DDT AND ITS METABOLITES IN ANTARCTIC KRILL (EUPHAUSIA SUPERBA DANA) FROM SOUTH ATLANTIC,
Warsaw Univ. (Poland). Dept. of Zoology and Ecology.
A. B. Lukowski.
Polskie Archiwum Hydrobiologii, Vol 25, No 3, p 663-668, 1978. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Pesticide residues, *DDT, *Path of pollutants, *Invertebrates, DDD, DDE, Antarctic, Gas chromatography, Chemical analysis, Chlorinated hydrocarbon, Pesticides, Insecticides, Food chains, *Krill, *Euphausia.

pp'DDE, pp'DDD and pp'DDT contents in bodies of krill from Antarctic waters of South Atlantic were determined by gas chromatography. Samples were taken in February and March 1976 in the following regions: Drake Passage, Bransfield Strait, South Georgia and South Sandwich Islands; the mean contents of total DDT were 0.0645, 0.0231, 0.0045 and 0.0040 ppm, respectively. Differences in the content and qualitative composition of total DDT between the samples from the different regions were considered from the standpoint of the dissimilarities in the age structure of the populations, and from the angle of the presumably higher local contamination with insecticide residues in the Drake Passage and Bransfield Strait regions. (Deal-EIS)
W80-00868

APPARATUS AND METHOD FOR THE DISCOVERY OF VOLATILE ORGANIC COMPOUNDS IN WATER,
Petro-Tex Chemical Corp., Houston, TX. (Assignee).
G. E. Button, J. R. Burke, and C. E. Dowden.
U.S. Patent No 4,154,086, 4 p, 1 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 831, May 15, 1979.

Descriptors: *Patents, *Water sampling, *Organic compounds, Water pollution sources, Separation techniques, Volatile organic compounds.

The invention is an apparatus for discovering trace amounts of volatile organic compounds in water comprising a column having a lower zone containing a heating means, a sample water outlet and a carrier gas inlet; and intermediate zone containing a condenser and sample water inlet--the sample water inlet being positioned below the condenser; and an upper zone having a gas detection means. The carrier gas inlet is located at the bottom of the lower zone or at some other point provided that the location of the carrier gas inlet is below the sample water outlet. The passage of the carrier gas through the water aids in stripping out volatile organic compounds. The carrier gas may be air, when the detection means operates by burning of the volatile organic compounds or it may be an inert gas if a chromatography column is used in the detection process. In the intermediate zone, the condenser is operated to condense any water vapor and return it to the lower zone of the column but not any volatilized organic compounds. There are baffles located below the water inlet to prevent contact surfaces which will become heated by the passage of the carrier gas from the heated portion of the column, where some of the lower boiling organic compounds will vaporize. The volatile organic compounds are those having boiling points below that of water under the conditions of pressure in the column. (Sinha-OEIS)
W80-00890

THE LIMNOLOGICAL RESPONSE OF A WEST VIRGINIA MULTIPURPOSE IMPOUNDMENT TO ACID INFLOWS,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 5B.
W80-00954

CHEMICAL AND PHYSICAL PROCESSES CONTROLLING THE CHEMICAL COMPOSITION OF SUSPENDED MATERIAL IN THE RIVER TAY ESTUARY,
Edinburgh Univ. (Scotland). Grant Inst., of Geology.
For primary bibliographic entry see Field 2L.
W80-00960

SUSPENDED SEDIMENT SOURCES IDENTIFIED BY MAGNETIC MEASUREMENTS,
Exeter Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W80-00964

THE EFFECTS OF URBANIZATION ON GROUND-WATER QUALITY--A CASE STUDY,
Wisconsin Univ. -Madison. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W80-00965

PREVALENCE OF ENTEROVIRUSES IN GROUND WATER OF ISRAEL,
Ministry of Health, Tel Aviv (Israel). Central Virus Lab.
Y. Marzouk, S. M. Goyal, and C. P. Gerba.
Ground Water, Vol 17, No 5, p 487-491, September-October 1979. 5 Tab, 32 Ref.

Descriptors: *Groundwater, *Viruses, *Bacteria, *Indicators, Sampling, Laboratory tests, Coliforms, Streptococcus, Correlation analysis, Pollutants, Path of pollutants, Water pollution, Water quality, Enteroviruses.

Few studies have been performed on the occurrence of enterovirus contamination of groundwater. In this study, 99 groundwater samples were examined for the presence of enteroviruses, total bacteria, fecal coliforms, and fecal streptococci by standard methods. Enteroviruses were isolated from 20% of the samples. Viruses were isolated from 12 samples which contained no detectable fecal organisms per 100 ml. No statistical correlation between presence of virus and bacteriological indicators could be determined. The widespread failure of current bacteriological standards to indicate the presence of potentially pathogenic enteroviruses in groundwater is an area of concern that requires more study. (Sims-ISWS)
W80-00966

TEMPORAL VARIATION IN THE NUTRIENT EXPORT OF RIVERS DRAINING INTO THE BAY OF QUINTE, ONTARIO, CANADA,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W80-00968

IN SITU FREEZING AS A CAUSE OF MORTALITY IN BROWN TROUT EGGS,
Wyoming Univ., Laramie. Water Resources Research Inst.
D. W. Reiser, and T. A. Wesche.
The Progressive Fish Culturist, Vol 41, No 2, p 58-60, 1979. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Fish eggs, *Mortality, *Cold Resistance, *Redds, Water temperature, Brown trout, Aquiculture, Seasonal, Spawning, Habitats, Fish reproduction, Flow, Water properties, Freezing, Water temperature, Loramie River, Wyoming.

In November 1975, 60 Vibert boxes, each containing 100 green eggs of brown trout (Salmo trutta), were placed in artificial redds in the Laramie River in southeastern Wyoming. Water depths and velocities were measured, and a representative substrate sample was collected at each site. Because of extensive ice cover in March 1976, only 20 of the 60 boxes of eggs were recovered. Survival of eggs in these boxes was low (average, less than 1%), and only 10 of the 20 boxes contained live eggs (survival range, 0.5 to 3.4%; average, 1.95%). Three boxes were completely frozen, even though they were buried 15 cm in the substrate and covered with 12 to 20 cm of flowing water. Eleven of the 20 redds, including two of the frozen sites, fell within established spawning criteria for brown trout (water depth, 9 cm or more; water velocity, 15-46 cm/s). No correlation was demonstrated between water depth and survival ($r=0.51$) or between water velocity and survival ($r=0.21$). Extremely low water temperature and in situ freezing of redds were the two main factors contributing to the high egg mortality. Freezing of redds may occur even in a suitable spawning environment. (Deal-EIS)
W80-00985

SOURCE ASSESSMENT: RECLAIMING OF WASTE SOLVENTS, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
D. R. Tierney, and T. W. Hughes.
Report EPA-600/2-78-004f, April 1978, 53 p, 13 Fig, 18 Tab, 45 Ref, 2 Append. 68-02-1874.

Descriptors: *Air pollution, *Solvents, *Industrial wastes, *Organic compounds, *Solvent reclamation, Water pollution sources, Industrial plants, Industrial production, Water pollution control, Water quality, Water quality standards, Industries, Pollutant identification.

The composition, quantity, and rate of air emissions from processes and facilities for waste solvent reclamation are reviewed. With a five percent annual increase in solvent reclamation, the total increase in 1977-1980 hydrocarbon emissions from these processes is about .03 percent or 59 metric tons. Described are: (1) processes, materials, and geographical distribution of solvent reprocessing; (2) emissions, including selected pollutants, emission factors, environmental effects, and definition of a hypothetical but statistically typical reclamation plant; (3) present status and expected future developments in control technology; (4) growth and nature of the solvents reclamation industry, including present and emerging technology and industry production trends. The plant is hypothesized in order to determine typical source sever-

ity. Population density for the plant is determined from data on locations of 30 private contractors sites selected at random and representing 19 states. Plant parameters include production capacity, population density and emission heights. Source severity is treated as maximum ground level concentrations divided by a hazard factor. Ground level concentration is derived by Gaussian plume methodology and ambient air quality standards represent hazard factors for criteria pollutants. (Harris-Wisconsin)
W80-00988

SEDIMENT OXYGEN DEMAND IN A SHALLOW OXBOW LAKE,
Illinois State Water Survey, Urbana.
T. A. Butts, and R. L. Evans.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110414, Price codes: A03 in paper copy, A01 in microfiche. ISWS Circular 136, 1979. 28 p, 4 Fig, 11 Tab, 20 Ref, 3 Append.

Descriptors: *Sediments, *Oxbow lakes, *Oxygen demand, *Illinois, On-site investigations, Data collections, Methodology, Analysis, Analytical techniques, Sampling, Instrumentation, On-site tests, Dissolved oxygen, Water quality, *Horseshoe lake(IL), Sediment oxygen demand.

In-situ sediment oxygen demand (SOD) measurements were made during the summer-fall of 1978 in HorseshoeLake (in the Mississippi River flood plain) in conjunction with a water quality sampling program. This report presented only the findings of the SOD investigation. Sediments throughout Horseshoe Lake exert a significant oxygen demand on the overlying water, with the highest demands in dead zones of the lake. The sediments on the basis of SOD rates alone can be classed as moderately polluted. Bacteria and other microorganisms are the principal cause of the demand; macroinvertebrates cause about 1% or less. The primary productivity of the lake is very high, and algal fallout may be a significant contributor to SOD. Dissolved oxygen in the lake is rapidly depleted in the absence of surface aeration or photosynthetic oxygen production. A simple mathematical model developed and verified to predict DO concentrations under warm, quiescent, dark conditions indicated that only about 36 hours would be needed to totally deplete DO under these conditions. The information generated by this study provides a good base from which to evaluate the degraded conditions of the sediments and the effects of these sediments on the oxygen resources of the lake. (Humphreys-ISWS)
W80-01010

REMOVAL OF 'SOLUBLE' IRON IN THE POTOMAC RIVER ESTUARY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
A. Eaton.
Estuarine and Coastal Marine Science, Vol 9, No 1, p 41-49, July 1979. 4 Fig, 1 Tab, 15 Ref, 1 Append.

Descriptors: *Estuaries, *Iron, *Potomac River, *Chesapeake Bay, Geochemistry, Chemicals, Sampling, Saline water-freshwater interfaces, Bacteria, Coagulation, Filters, Filtration, Chemistry analysis, Water quality, Heavy metals, Colloids, Pollutants, Path of pollutants, Geochemical cycle.

'Soluble' iron levels in the Potomac River estuary are extremely low, usually less than 0.5 micro-M at mile 90 (freshwater) and decrease downstream to less than 0.05 micro-M prior to the intrusion of salt water. Removal of 'soluble' and fine filterable iron in the freshwater obeys first order kinetics with a rate constant of about 0.1/day. Addition of bacteriocides to samples stabilizes iron concentrations, suggesting that in this estuary freshwater colloids are destabilized by bacterial polymers. The extensive removal of iron in freshwaters is a different phenomenon from the salinity-dependent removal observed by several other workers in different estuaries. (Sims-ISWS)
W80-01014

SURVEY OF SOME CANADIAN LAKES FOR THE PRESENCE OF ULTRASTRUCTURALLY DISCRETE PARTICLES IN THE COLLOIDAL SIZE RANGE,
National Water Research Inst., Burlington (Ontario).
A. Massalski, and G. G. Leppard.
Journal of the Fisheries Research Board of Canada, Vol 36, No 8, p 906-921, August 1979. 17 Fig, 1 Tab, 9 Ref.

Descriptors: *Lakes, *Canada, *Colloids, *Suspended solids, Surveys, On-site investigations, Clays, Sediments, Particle size, Particle shape, Limnology, Water sampling, Methodology, Laboratory tests, On-site data collections, Analysis, Analytical techniques, Electron microscopy, Foreign research, *Fibrils.

Water samples from 9 Canadian lakes were centrifuged, and the pellets were analyzed by transmission electron microscopy. The pellets included small organisms, organic colloids, and clay particles. In almost all the samples, colloids were the major component revealed following thin-section analysis. When viewed at high magnification, much of each pellet consisted of morphologically discrete particles, some of which were readily categorized. Electron-opaque fibrils of colloidal size were frequently encountered (1) at different depths, (2) as a coating on the surface of algae and bacteria, (3) overlaying the sediments, (4) as an apparent adhesive between a variety of particles, and (5) as a component of froth at the water-air interface. They were common at all times and in lakes of various trophic levels and sizes. (Humphreys-ISWS)
W80-01037

FINE PARTICULATE ORGANIC CARBON OUTPUT FROM FENS AND ITS EFFECT ON BENTHIC MACROINVERTEBRATES,
California Univ., Berkeley. Dept. of Forestry and Conservation.
D. C. Erman, and W. C. Chouteau.
Oikos, Vol 32, No 3, p 409-415, 1979. 6 Fig, 1 Tab, 29 Ref.

Descriptors: *Toxicity, *Benthic fauna, *Fen, Benthos, Suspended solids, Carbon, Organic compounds, Streams, Aquatic insects, Dominant organisms, Invertebrates, Seasonal, Sagehen Creek, California, Productivity.

Fine particulate organic carbon (FPOC) output was sampled from three fens in the Sagehen Creek basin in the Sierra Nevada mountains to establish any seasonal or daily trends in output. Stream invertebrates were sampled to determine if they were more abundant below fen outlets to Sagehen Creek. We found the fens released large quantities of FPOC annually (5 to 20 g /sq m/yr) with the greatest concentrations from all fens combined occurring in summer (2 mg/1). Large fluctuations in output occurred in summer; lowest concentration was in afternoon coincident with high stream temperature and low discharge. Filter feeding blackflies in Sagehen Creek were significantly more abundant below fen outlets than above, but other benthic macroinvertebrates showed no response. (Deal-EIS)
W80-01045

EFFECTS OF A THERMAL DISCHARGE ON REPRODUCTIVE CYCLES IN MYTILUS EDULIS AND MYTILUS CALIFORNIANUS (MOLLUSCA, BIVALVIA),
California Univ., Berkeley. Dept. of Zoology.
A. H. Hines.
Fishery Bulletin, Vol 77, No 2, p 498-503, 1979. 5 Fig, 19 Ref.

Descriptors: *Thermal stress, *Toxicity, *Mussels, Water temperature, Thermal powerplants, Cooling waters, Reproduction, Animal physiology, Seasonal, Cycles, Biorhythms, Size, Energy budget, Morro Bay, Calif., Mytilus.

This study examined the effect of a thermal discharge from a coastal steam-electric power plant on reproduction in M. edulis and M. californianus in central California. The reproductive cycles and gonadal weights of these mussels in the warm water outfall and in control regions of naturally occurring temperatures were compared using body component index methods. Water temperatures in the outfall exceeded 20C much of the late summer and early fall, while plant intake temperatures were usually in the 12-15C range and rarely exceeded 17C. The gonadal indexes of M. edulis from the outfall and from the control populations showed the same distinct cycle of gonads increasing in size during summer and fall and dropping to a low in spring. However, gonadal weights of the outfall population were lower than the controls, as can be seen by the generally lower level of the outfall gonadal index. In contrast to M. edulis, the gonadal index of M. californianus did not show a distinct annual cycle. Contrary to the trend shown by gonadal index levels, outfall body weight/shell volume indexes were consistently lower than the controls, indicating that the control mussels were in better nutritional conditions. (Deal-EIS)
W80-01046

AN APPARATUS FOR STUDYING THE EFFECT OF PH AND CO2 ON FISH EMBRYOS,
Akademiya Nauk URSR, Kiel. Inst. Hidrobiologii.
V. P. Bil'ko
Hydrobiological Journal, Vol 13, No 4, p 110-114, 1977. 2 Fig, 1 Tab, 28 Ref

Descriptors: *Research equipment, *Carbon dioxide, *Hydrogen ion concentration, Laboratory equipment, Electrical equipment, Monitoring, Bioassay, Laboratory tests, Aquaria, Embryonic growth stage, Water chemistry, Fresh water fish, Methodology

An analysis of existing techniques for maintaining a present pH and CO2 level in experiments with fish is given. The major drawbacks of these methods are discussed and an apparatus designed to eliminate these flaws is described. The main elements of the apparatus are electronic instruments: a pH meter and automatic titrimeter. The main drawback of our apparatus is its complexity. (Deal-EIS)
W80-01047

ZINC CONCENTRATIONS IN JUVENILE FLATFISH,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
N. J. Milner
Journal of the Marine Biological Association of the United Kingdom, Vol 59, p 761-775, 1979. 5 Fig, 7 Tab, 44 Ref

Descriptors: *Zinc, *Marine fish, *Juvenile growth stage, Sediments, Shrimp, Weight, Growth stages, Regression analysis, Seasonal, Path of pollutants, Metals, Fish physiology, Animal metabolism, Chemical analysis, Water chemistry, Wales, England, Humber Estuary, *Plaice, *Tissue analysis, *Bioaccumulation.

Zinc concentrations were measured in sediments, shrimps and the juveniles of four species of flatfish from beaches in South Wales and the Humber Estuary. Body weight (W) was the major source of variability in flatfish zinc concentration (Mc). Regression analysis removes this source of variation and the slope (Kc) and intercept (ln a) of the equation $\ln Mc = \ln a + Kc \ln W$ were used to investigate inter-and intra-specific variation. Slopes of the regressions were found to be species-specific, and interspecific variations in zinc levels were demonstrated by the intercepts, which showed seasonal variation in plaice. At any one time zinc concentration in O-group plaice was inversely related to body weight, and over the first 2 years of life concentrations also decreased with growth; but seasonal fluctuations impinged on this decrease to cause an increase during the first winter. No geographical variation was observed that correlated with sediment or shrimp zinc levels. Reasons for the weight-specific nature and the seasonal variation of zinc concentrations are discussed. (Deal-EIS)
W80-01048

CELL-FREE BENZO(A)PYRENE HYDROXYLASE ACTIVITY IN MARINE ZOOPLANKTON,
Kent Univ., Canterbury (England). Biological Lab.
J. M. Walters, R. B. Cain, I. J. Higgins, and E. D. S. Corner.
Journal of the Marine Biological Association of the United Kingdom, Vol 59, p 553-563, 1979. 3 Fig, 4 Tab, 25 Ref.

Descriptors: *Enzymes, *Zooplankton, *Organic compounds, Oil, Metabolism, Biodegradation, Copepods, Biochemistry, Crab, Chemical analysis, Regression analysis, Invertebrates, Polyaromatic hydrocarbons, Benzo(a) pyrene.

Samples of mixed zooplankton, mixed microplankton and two individual species of calanoid copepod were assayed for benzo(a)pyrene hydroxylase (aryl hydrocarbon hydroxylase) as part of an investigation to determine the contribution of zooplankton to the metabolism of hydrocarbons in the sea. Cell-free preparations from all the plankton samples tested contained benzo(a)pyrene hydroxylase activity. In addition, exposure of Calanus to various hydrocarbons at concentrations ranging from 50 to 200 microg/1 caused increased activity of the enzyme, in some instances that of treated animals being more than twice that of untreated controls. (Deal-EIS)
W80-01049

NITROGEN GAS SUPERSATURATION DURING ARTIFICIAL AERATION AT LAKE CASITAS, CALIFORNIA,
Limnological Associates, Kaneohe, HI.
A. W. Fast.
The Progressive Fish Culturist, Vol 21, No 3, p 153-155, 1979. 1 Fig, 7 Ref.

Descriptors: *Water chemistry, *Nitrogen, *Aeration, Lake Casitas, California, Oxygen, Water temperature, Reservoirs, Gases, Supersaturation, Zone of saturation, Fishkills, Dissolved bases, Lake management.

Artificial aeration of lakes by compressed air injection is a potential source of nitrogen gas supersaturation. Artificial destratification by aeration (that is, thermal destratification through the mixing of bottom waters with surface waters by air injection near the bottom) is such a possible source of gas supersaturation. This possibility was investigated in an artificial impoundment that has been artificially aerated since 1968. Nitrogen gas was measured with a tensionmeter. Results showed that artificial destratification by air injection can cause excessive nitrogen gas saturation relative to surface pressures. The major risk is that if bottom waters were released from the reservoir, massive fish mortalities could result downstream. (Deal-EIS)
W80-01050

LONG-TERM RESIDUAL EFFECTS OF POLYETHYLENEIMINE ON DAPHNIA,
Moscow State Univ. (USSR).
N. S. Stroganov, N. N. Maksimova, and Isakova Ye. I.
Hydrobiological Journal, Vol 13, No 3, p 74-82, 1977. 5 Fig, 3 Tab, 13 Ref.

Descriptors: *Daphnia, *Toxicity, *Organic compounds, Mortality, Genetics, Animal physiology, Reproduction, Fecundity, Animal behavior, Growth rates, Size, Length, *Polyethyleneimine, *Mutagens.

Polyethyleneimine exerts a multifaceted effect on Daphnia magna Straus. At concentrations of 0.1 mg/liter, it caused negligible deviations from the control. At concentrations of over 1 mg/liter, the preparation was highly toxic. In 1 mg/liter solution Daphnia lived for seven generations and reproduced, but mortality increased, the rate of sexual maturation changed, as did fecundity and moulting. From the second generation on, dwarf forms appeared, the numbers of which increased, reaching 100 percent in the fourth generation. The body size of the cladocerans decreased by an average of factor 2.3 in the six generations. When the Daphnia were transferred to pure water, the dwarfs persisted in all subsequent generations. The mechanism of the inherited changes is discussed. (Deal-EIS)
W80-01051

THE EFFECTS OF MACROPHYTES ON HYDROCHEMISTRY OF THE SHALLOWS OF THE KREMENCHUG RESERVOIR,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
A. I. Merezhko, A. K. Ryabov, and G. V. Tsytsarin.
Hydrobiological Journal, Vol 13, No 3, p 97-100, 1977. 3 Tab, 9 Ref.

Descriptors: *Water chemistry, *Aquatic plants, *Reservoirs, Hydrogen ion concentration, Oxygen, Calcium, Photosynthesis, Trace elements, Estuaries, Seasonal, Dissolved oxygen, USSR, Kremonchug Reservoir, Water quality, Iron, Copper, Zinc, Manganese.

Data are presented on the effects of higher aquatic plants on chemistry of shallow waters of this reservoir. It is shown that the change in the pH is determined by the photosynthetic activity of the plants. A correlation was established between calcium ion content and photosynthesis by the plants. A positive effect by the plants on the oxygen content of the shallow waters is noted. (Deal-EIS)
W80-01052

AN OPTICAL METHOD FOR RECORDING CARDIAC RHYTHM IN DAPHNIA,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Tsellyulozno-Bumazhnoi Promyshlennosti, Leningrad (USSR).
B. I. Kolupayev, A. A. Andreyev, and Yu. K. Samoylenko.
Hydrobiological Journal, Vol 13, No 3, p 104-105, 1977. 3 Fig, 3 Ref.

Descriptors: *Research equipment, *Daphnia, Laboratory equipment, Equipment, Monitoring, Animal metabolism, Animal physiology, Respiration, *Phenols, Toxicity, Bioassay, Electrical equipment, Optical properties.

An apparatus for the automatic recording of respiration and cardiac activity in Daphnia is described. The device utilizes an optical system in which a light flux is passed through the transparent body of the Daphnia. Cardiac or respiratory movement alters the beam, which is detected by a photoresistor. A counter or electro-cardiograph is used to quantify the changes in the light. Test with Daphnia in pure lake water and in phenol confirmed its suitability for such investigations. (Deal-EIS)
W80-01053

THE CHRONIC EFFECT OF ALKALI ON THE GROWTH, DEVELOPMENT AND FECUNDITY OF THE GUPPY,
Tsentralnyi Gosudarstvennyi Nauchno-Issledovatelskii Inst. Ozernogo i Rechnogo Rybnogo Khozyaistva, Baku (USSR). Azerbaijan Branch.
Sh. A. Rustamova.
Hydrobiological Journal, Vol 13, No 3, p 83-85, 1977. 8 Ref.

Descriptors: *Toxicity, *Alkalis(Bases), *Fish physiology, Growth rates, Fecundity, Fish reproduction, Mortality, Sodium compounds, Carbonates, Water chemistry, Fresh water fish, Sodium hydroxide, Sodium carbonate, *Guppies, *Lebistes.

The chronic effects of low concentrations (25 to 100 mg/liter) of NaOH and Na2CO3 in several generations of guppies were elucidated in long-term tests. The survival and weight increase of the fish declined, sexual maturity was late or premature, fecundity was low, the quality of the progeny deteriorated and the fishes gradually died out. Sodium hydroxide concentrations of 25 mg/liter and over are toxic, as are those of 50 mgNa2CO3/liter and over. (Deal-EIS)
W80-01054

METERING DEVICE FOR TOXICANTS USED IN BIOASSAYS WITH AQUATIC ORGANISMS,
Canada Centre for Inland Waters, Burlington (Ontario).
P. V. Hodson.
The Progressive Fish Culturist, Vol 41, No 3, p 129-131, 1979. 1 Fig, 6 Ref.

Descriptors: *Research equipment, *Bioassay, Methodology, Laboratory equipment, Equipment, Pumps, Research and development, Monitoring, Laboratory tests, Siphons, Testing, Toxicity, Toxicants.

A metering device for assuring accurate and continuous delivery of toxicants into continuous flow-through bioassay systems is described. The meter has the advantages of being fail-safe and no moving parts. The metering system has been in use by the authors for more than four years in bioassays lasting up to a year. (Deal-EIS)
W80-01055

RED SWAMP CRAYFISH: SHORT-TERM EFFECTS OF SALINITY ON SURVIVAL AND GROWTH,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
B. A. Sharfstein, and C. Chafin.
The Progressive Fish Culturist, Vol 41, No 3, p 156-157, 1979. 1 Fig, 2 Ref.

Descriptors: *Crayfish, *Growth rates, *Salinity, Aquiculture, Toxicity, Animal physiology, Water chemistry, Mortality, Aquatic animals, Salt tolerance, Crustaceans, Commercial shellfish, *Procambarus.

The ability of red swamp crayfish (Procambarus clarkii) to survive and grow during a one-month exposure to salinities ranging from 0 to 12 o/oo (0,3,6,9,12) Was investigated. Crayfish survived, molted, and grew at all test salinities; cast exoskeletons were found in all the culture tanks. Individuals in the 3 to 12 o/oo treatments lost their usual reddish tinge, and became a mottled green-gray. One death occurred in a 12 o/oo replicate 1 day before the end of the experiment. Average growth rate during the experimental period was inversely correlated with increasing salinity ($r = -0.085$). The highest average weekly growth rate, 17.2%, was in the 0 o/oo replicates; the lowest, 6.33%, was in the 12 o/oo replicates. Growth rates in the 3,6, and 9 o/oo treatments were intermediate between these two and differed little at 11.7, 11.8 and 12.7%, respectively. (Deal-EIS)
W80-01056

PHYSIOLOGICAL MECHANISMS OF THE ACTION OF TOXIC SUBSTANCES, AND ADAPTATION OF AQUATIC ANIMALS TO THEM,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
B. A. Flerov.
Hydrobiological Journal, Vol 13, No 4, p 70-74, 1977. 17 Ref.

Descriptors: *Toxicity, *Daphina, *Organic compounds, *Phenols, Pesticide toxicity, Mortality, Animal physiology, Cytological studies, Adaptation, Animal populations, Aquatic populations, Mode of action, *Lindane, *Chlorofos, *Trichlorfon.

The present paper describes investigations of the effect of such widely distributed toxic compounds as phenol, Chlorofos (Russian equivalent of Trichlorfon) and benzene hexachloride on the physiological functions of aquatic animals, their action at the cellular, organism, and population levels, and also the possibilities and modes of adaption of aquatic animals to these toxic agents. Phenol acted as an uncoupler of oxidative phosphorylation, depressing active sodium transport and other processes connected with utilization of high-energy compounds. Chlorofos interfered with nervous activity via its anticholinesterase activity. Benzene hexachloride (lindane) was found to disturb synaptic transmission. Features of the effect of toxic

substances are exemplified by reference to Daphnia pulex. It is concluded that there is an absence of individual adaptation of organisms to toxic substances and it is shown that the main mechanism of adaptation of populations is the selection of resistant individuals, this being a non-specific mechanism. (Deal-EIS)
W80-01057

ABILITY OF CHIRONOMID LARVAE TO COLONIZE SUBSTRATES VARIOUSLY POSITIONED IN A LAKE,
Moscow State Univ. (USSR).
A. S. Konstantinov.
Hydrobiological Journal, Vol 13, No 4, p 11-14, 1977. 1 Tab, 7 Ref.

Descriptors: *Diptera, *Habitats, *Larval growth stage, Lakes, Periphyton, Aquatic insects, Aquatic populations, Biomass, Light penetration, Depth, Methodology, Monitoring, *Substrates.

In the present work information is given on colonization by chironomid larvae-one of the commonest components of freshwater periphyton- of substrates in relation to the orientation of such substrates and their position in the water body. Wood planks, placed horizontally or vertically at various depths, were used as substrates. The mean concentration of larvae on horizontal planks was approximately one and a half times greater than that on vertical surfaces. In horizontal planks the concentrations of larvae on the bottom side was approximately half that on the upper side. With depth of immersion, the concentration of chironomid larvae on the upper side of the horizontal planks at first increases and then falls off, reflecting a systematic change in favorable conditions with depth. (Deal-EIS)
W80-01058

TOXICITY OF SOME HEAVY METALS FOR DAPHNIA MAGNA STRAUSS, AS A FUNCTION OF TEMPERATURE,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
E. P. Sheherban.
Hydrobiological Journal, Vol 13, No 4, p 75-80, 1977. 2 Fig, 15 Ref.

Descriptors: *Daphnia, *Toxicity, *Heavy metals, *Water temperature, *Copper, *Zinc, *Cadmium, *Nickel, *Manganese, Bioassay, Growth stages, Mortality, Animal behavior, Crustaceans.

The effect of sulfate salts of copper, zinc, cadmium, nickel, and manganese on young Daphnia magna Strauss and on the sexually mature females in acute experiments (24, 48, and 72 hours) at 10, 15, 25, and 30C is described. The toxicity of Cu2+, Zn2+, Cd2+, Ni2+andMn2+,increases with temperature. In the temperature interval from 25 to 30C toxicity of cadmium increases by three to four orders of magnitude, that of copper and zinc by two orders. Nickel and manganese are of relatively low toxicity. (Deal-EIS)
W80-01059

THE MARINE LIFE OF AN OFFSHORE OIL PLATFORM,
International Biological Consultants, Encinitas, CA.
A. Wolfson, G. Van Blaricom, N. Davis, and G. S. Lewbel.
Marine Ecology-Progress Series, Vol 1, p 81-89, 1979. 4 Fig, 2 Tab, 26 Ref.

Descriptors: *Offshore platforms, *Habitats, *Dominant organisms, California, Marine plants, Marine animals, Aquatic populations, Oil, Mussels, Productivity, Trophic level, Biomass, Fouling, Benthic fauna, Polychaetes, Huntington Beach, *Species diversity.

The research at Union Oil Platform EVA, off Huntington Beach, California, USA, was aimed at understanding how man-made offshore structures function as artificial reefs and how they modify the surrounding marine environment. Underwater surveys were conducted to determine: (1) the distribution, standing stock and productivity of attached 'fouling' organisms, (2) the density, size-structure, and biomass of epibenthic populations beneath the platform, and (3) the abundance, species composition and distribution of epifaunal and infaunal benthos as a function of distance away from EVA. The platform substructure is overgrown with dense clumps of sea mussels. An estimated cubic meter of mussels falls from the platform each day, supporting extraordinary densities (29 m-2) of sea stars on the bottom. Sea stars are prevented from climbing up onto the platform by bands of stinging sea anemones on EVA's base. The adjacent sand community is strongly influenced by EVA's presence with densities of some species greatly enhanced and others significantly reduced by proximity to the structure. A trophic model of dominant faunal elements in the oil platform ecosystem indicates high productivity and turn-over for the attached community. (Deal-EIS)
W80-01060

ABORTION EFFECT IN CORALS INDUCED BY OIL POLLUTION,
Tel Aviv Univ. (Israel). Dept. of Zoology.
Y. Loya, and B. Rinkevich
Marine Ecology-Progress Series, Vol 1, p 77-80, 1979. 2 Fig, 21 Ref.

Descriptors: *Oil pollution, *Toxicity, *Coral, Coral reefs, Reproduction, Oil, Oil spills, Organic compounds, Larval growth stage, Reefs, Mortality, Metabolism, Physiology, *Crude oil, Iranian crude, Gulf of Eilat.

Sublethal concentrations of Iranian crude oil induce immediate mouth-opening in the Red Sea coral Stylophora pistillata, followed by premature extrusion of planulae larvae. Laboratory experiments with different concentrations of water soluble fractions(WSF) of Iranian crude oil (0.1-10.0 ml/l) showed that the average number of planulae extruded in each oil concentration was significantly higher than in the control. In natural conditions S. pistillata sheds its planulae only during the night. In presence of WSF of crude oil, shedding is immediate, day or night. Sheddingof planulae during an oil spill decreases their viability and chances of successful settlement. In chronically oil-polluted reefs, such as the coral nature reserve of Eilat, almost no colonization of new coral colonies occurs, while high colonization is evident in reef areas free of oil pollution. (Deal-EIS)
W80-01061

UPTAKE AND ACCUMULATION OF CADMIUM BY OPHRYOTROCHA DIADEMA (POLYCHAETA),
Biologische Anstalt Helgoland Hamburg. (Germany, F.R.).
K. Klockner.
Marine Ecology-Progress Series, Vol 1, p 71-76, 1979. 3 Fig, 28 Ref.

Descriptors: *Absorption, *Cadmium, *Polychaetes, Benthic fauna, Heavy metals, Water chemistry, Sea water, Reproduction, Path of pollutants, Animal physiology, Growth stages, Sorption, Chemical analysis, Spectrophotometry, *Bioaccumulation, *Tissue analysis, *Ophryotrocha.

Cadmium uptake by the deposit-feeding polychaete, Ophryotrocha diadema, is a non-linear process related to exposure time and metal concentration in ambient seawater (20C; 31 o/ooS). Maximum body loads of 1700 ppm Cd were found in adult worms (up to 0.1 mg dry weight) after 64-day exposure to 1000 ppb Cd. Distinct saturation of absorption was not reached during this time Accumulation factors decreased exponentially with increasing contamination levels. Accumulation factors were 7900 to 1700, calculated on a dry weight basis, corresponding to 3400 to 660 estimated on a theoretical volume basis of single worms in levels of 10 to 1000 ppb Cd. Cd content of 62- to 116-day-old worms of three consecutive generations subjected to permanent contamination did not increase from the P- to the P2-generation. A linear correlation exists between Cd absorption of newly deposited egg masses and experimental Cd concentrations. Cd loads of egg masses were extremely (12 to 280 ppm Cd dry weight in 50 to 1000 ppb Cd contamination) compared with parental organisms. Cd content of the egg masses also did not increase within consecutive generations. It is, therefore, assumed that parentally accumulated Cd loads are not transferred to the offspring. Contamination of egg masses probably occurred after spawning, due to sorption of the metal by the mucoid layer encapsulating the eggs, since similar results were noted for Cd sorption by food particles (fragmented spinach). (Deal-EIS)
W80-01062

EFFECTS OF OXYGEN TENSION ON PUMPING, FILTRATION AND OXYGEN UPTAKE IN THE ASCIDIAN PHALLUSIA MAMMILLATA,
Paris-6 Univ. (France). Lab. Arago.
A. Fiala-Medioni.
Marine Ecology-Progress Series, Vol 1, p 49-53, 1979. 3 Fig, 3 Tab, 13 Ref.

Descriptors: *Oxygen requirements, *Animal metabolism, Animal physiology, Animal behavior, Water chemistry, Oxygen, Filtration, Dissolved oxygen, Analytical techniques, Mollusks, Clams, *Phallusia.

The effects of declining oxygen tension on pumping, filtration and oxygen uptake were studied simultaneously in Phallusia mammillata. Identical effects were observed on rates of pumping and filtration; these remain constant until the oxygen tension (pO2) falls to a mean level of 119 mm Hg (concentration = 3.85 ml 02/l) and then decrease. Below a p02 of 98 mm Hg (3.18 ml 02/l) the rates decrease more rapidly and become more variable. No particular rhythms emerged. Below a pO2 of 119 mm Hg, rapid and rhythmic variations in the diameter of the cloacal siphon produce a pseudorhythm. Filtering efficiency stays constant, with values of 77 to 79%. The mechanism of mucus formation is not affected down to a pO2 of 98 mm Hg. Below a mean pO2 of 119 mg Hg - the critical tension - oxygen uptake decreases; P. mammillata fails to regulate oxygen consumption, and becomes a 'conformer'. (Deal-EIS)
W80-01063

PERSISTENCE OF POLYCHLORINATED BIPHENYLS AND 1,1-DICHLORO-2,2-BIS(P-CHLOROPHENYL) ETHYLENE (P,P'-DDE) WITH AGE IN LAKE TROUT AFTER 8 YEARS,
Cornell Univ., Ithaca, NY. Dept. of Food Science.
P. C. Wszolek, D. J. Lisk, T. Wachs, and W. D Youngs.
Environmental Science and Technology, Vol 13, No 10, p 1269-1271, 1979. 2 Fig, 1 Tab, 39 Ref

Descriptors: *Pesticide residues, *Persistence, *Lake trout, New York, Polychlorinated biphenyls, DDE, Chlorinated hydrocarbon pesticides, Chemical analysis, Aroclors, Path of pollutants, Age, Public health, *Tissue analysis, *Bioaccumulation.

Lake trout, ranging in age from 6 to 12 years, were netted in Cayuga Lake in Central New York in 1978 and analyzed for polychlorinated biphenyls (PCBs) and 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene (p,p'-DDE). Fresh weight concentrations in flesh of the 12-year old fish were about 13 ppm of PCBs and 3-4 ppm of p,p'-DDE The data indicated that, whereas p,p'-DDE had decreased considerably, PCB concentrations remained about the same as those in a similar series of aged lake trout sampled from Cayuga Lake in 1970. The PCBs present in the fish most closely resembled Aroclor 1254 but appeared to contain a higher proportion of more highly chlorinated isomers. (Deal-EIS)
W80-01064

TEMPERATURE AND SALINITY EFFECTS ON THE ACUTE TOXICITY OF CADMIUM TO LAOMEDEA LOVENI (HYDROZOA),
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde
H. Theede, N. Scholz, and H. Fisher
Marine Ecology-Progress Series, Vol 1, p 13-19,

1979. 3 Fig, 4 Tab, 42 Ref.

Descriptors: *Cadmium, *Toxicity, *Water temperature, *Salinity, Heavy metals, Sea water, Salt tolerance, Absorption, Bioindicators, Bioassay, *Bioaccumulation, *Tissue analysis, *Polyps, *Laomedea, Marine animals.

The hydroid polyp Laomedea loveni Allm. responds to very low cadmium concentrations in sea water (microg Cd/1 range). The acute toxicity of Cd is strongly modified by abiotic factors. At low temperatures and high salinities L. loveni is more tolerant to Cd contamination than at the reverse temperature-salinity combinations. The Cd concentration causing irreversible retraction of 50% of the hydranths after a 7-day exposure of polyp colonies (7d ED50) varies from 3 microg 1-1 (at 17.5C and 10 o/ooS) to 80 microg 1-1 (at 7.5C and 25 o/ooS). The accumulation of Cd increases at higher temperatures. (Deal-EIS)
W80-01065

TOXICITY OF COPPER COMPOUNDS FOR CHLORELLA PYRENOIDOSA BEYER,
Moscow City Council (USSR). Inst. for the Design and Planning of the Water Supply and Sewer Systems.
G. K. Barashkov, and N. M. Kiristayeva.
Hydrobiological Journal, Vol 13, No 4, p 80-83, 1977. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Toxicity, *Copper, *Chlorella, Analytical techniques, Chemical analysis, Monitoring, Copper compounds, Copper sulfate, Aquatic algae, Biomass, Chlorophyta, Nitrates, Chlorides, Bioassay.

A new method for quantitative assessment of relative toxicities of some copper compounds on algae showed that these vary by a factor of 235. Distortions in the results by the biomass effect can be avoided by introducing an internal standard of toxicity based on CuSO4 and expressing the results in units of toxicity (toxae). Our data show the necessity of supplementing the system of monitoring surface-water quality with direct determinations of toxicity via biological tests. (Deal-EIS)
W80-01066

OBSERVATIONS OF MERCURY LEVELS IN BRANCHIOSTOMA CARIBAEUM,
Swedish Water and Air Pollution Research Lab., Stockholm.
A. Jernelov, O. Linden, and L. Lindestrom.
Marine Pollution Bulletin, Vol 10, p 258-259, 1979. 1 Fig, 4 Ref.

Descriptors: *Mercury, *Benthic fauna, *Baseline studies, Chemical analysis, Industrial wastes, Chemical wastes, Heavy metals, Path of pollutants, Sampling, Absorption, Cartagena Bay, Colombia, *Cephalocordates, *Branchiostoma, *Lancelets.

This report presents baseline data on mercury levels in cephalocordates. Lancelets (Branchiostoma caribaeum) were collected in bottom samples in Cartagena Bay Colombia at various distances from the mercury source. Mercury content was determined by the flameless atomic absorption method. The mercury concentrations ranged from 24 to 360 ppb. Factors influencing mercury levels were distance from the mercury source and prevailing currents in the bay. (D-EIS)
W80-01067

ACCUMULATION OF MERCURY AND SELENIUM IN CULTURED YELLOWTAIL,
Shimonoseki Univ. of Fisheries (Japan). Dept. of Food Science and Technology.
M. Takeda, and T. Ueda.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 7, p 901-904, 1979. 7 Fig, 10 Ref.

Descriptors: *Mercury, *Absorption, Agriculture, Fish physiology, Path of pollutants, Chemical analysis, Heavy metals, Chemical properties, Growth stages, Animal metabolism, Food webs, *Selenium, *Bioaccumulation, *Tissue analysis, *Yellowtail, *Seriola, *Methylmercury.

The accumulation of mercury and selenium in different tissues were followed by using commercially cultured young yellowtail, Seriola quinqueradiata. The levels of mercury increased significantly with growth in dorsal muscle of the fish fed mainly with sardines (mean mercury level is 0.05 microg/g) and these concentrations were at similar levels to those of wild fish. On the other hand, the mercury levels in dorsal muscle of yellowtail fed with mackerel(mean mercury level is 0.09 microg/g) alone were higher than those fed with sardines. The mercury level of liver was lower than that of dorsal muscle and independent of the latter. Heart tissue contained the highest amount of mercury among the organs analyzed. The mean ratios of methylmercury to total mercury of dorsal and dark muscle were about 65 and 85%, respectively. The correlation between the level of selenium and that of total mercury was significant in dorsal muscle. The mean molar ratios of selenium to mercury in dorsal, dark, and abdominal muscle were 19, 28, and 19, respectively. (Deal-EIS)
W80-01068

THE EFFECT OF SEWAGE AND INDUSTRIAL WASTE DISCHARGES ON THE PRIMARY PRODUCTION OF A SHALLOW TURBULENT RIVER,
Vikram Univ., Ujjain (India). School of Studies in Botany.
S. V. R. Rao, V. P. Singh, and L. P. Mall.
Water Research, Vol 13, p 1017-1021, 1979. 8 Tab, 19 Ref.

Descriptors: *Sewage effluents, *Industrial wastes, *Primary productivity, *Toxicity, Turbulence, Rivers, Respiration, Productivity, Flow rates, River flow, Tropical regions, Water chemistry, Seasonal, Water pollution effects, River Khan, *India.

Sewage and industrial waste discharges have been found to have a deleterious effect on the primary productivity of the shallow turbulent tropical river Khan (Indore) India. Even though net primary production rates have exceeded the respiration rates in the early recovery zone, the industrial wastes and sewage discharges have been found to decrease the overall productivity of the river. The above studies have been compared with other investigations in the temperate regions of the world, which generally refer to the effects of organic pollution on the primary productivity of the running which generally refer to the effects of organic pollution on the primary productivity of the running waters. The present investigations lead to a generalized observation that in tropical running waters, toxic industrial wastes and sewage discharges have a depressing effect on the overall production rates. However, comparable studies in the temperate regions are nonexistent, as the studies in the temperate regions mainly refer to organic pollution and do not take into account the effects of toxic industrial waste and sewage discharges. (Deal-EIS)
W80-01069

AN INVESTIGATION ON THE MERCURY CONTAMINATION OF PERSIAN GULF FISH,
Tehran, Univ. (Iran). Dept. of Food Hygiene.
V. Parvaneh.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 357-359, 1979. 1 Tab, 12 Ref.

Descriptors: *Baseline studies, *Mercury, *Commercial fish, Chemical analysis, Fish physiology, Path of pollutants, Heavy metals, Public health, Spectrophotometry, Marine fish, *Persian Gulf, *Tissue analysis, *Bioaccumulation.

The present study was performed to establish baseline data on the mercury content of Persian Gulf fish. Random samples of the four most important fish, Cybium comersonii, C. guttatum, Lutjanus coccineus and Psettodes erimei as well as samples of canned tuna (Euthynnus offinis) were analysed. Samples of the edible parts of the fish were studied using flameless atomic absorption spectrophotometry. The level of mercury ranged from 0.04 to 0.56 mg/kg. Tuna had the highest mean concentration, 0.30 mg/kg, followed by L. coccineus, 0.19, C. comersonii, 0.17, P. erumei, 0.15, and C. guttatum, 0.14. (Deal-EIS)
W80-01070

IN VIVO AND IN VITRO EFFECT OF PHENOCLOR DP6 ON DRUG METABOLIZING ACTIVITY IN MULLET LIVER,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
J. F. Narbonne, and J. L. Gallis.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 338-343, 1979. 2 Tab, 30 Ref.

Descriptors: *Polychlorinated biphenyls, *Toxicity, *Enzymes, Fish physiology, Animal metabolism, Mode of Action, Biochemistry, Fish diets, Path of pollutants, Mullets, *Tissue analysis, *Liver, *Phenoclor.

This paper describes the effects of Phenclor DP6 on mixed function oxidase system activities in hepatic microsomes of estuarine fish. Two groups of mullet (Chelon labrosus) were used. One group was fed a diet containing 50 microg/g Phenoclor D6 while the other group served as control. After eight days of feeding all fish were sacrificed and the livers were analysed. Liver hydroxylase and demethylase activities as well as cytochrome P450 and cytochrome b5 contents are significantly increased in treated fish, rising from 63 to 118 per cent with respect to control values. Aniline hydroxylase activity and cytochrome b5 concentration are more sensitive to DP6 treatment than aminopyrine-N-demethylase and cytochrome P450. However, as has been shown in rat liver studies, the last two microsomal parameters correlate very well. The results of the present study clearly indicate the ability of PCB to induce the fish hepatic drug metabolizing enzymes. (Deal-EIS)
W80-01071

ACUTE TOXICITY TO SELENASTRUM CAPRICORNUTUM OF AROMATIC COMPOUNDS FROM COAL CONVERSION,
Oak Ridge National Lab. TN.
J. M. Giddings.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 360-364, 1979. 1 Tab, 9 Ref.

Descriptors: *Toxicity, *Aromatic compounds, *Aquatic algae, Coals, Organic compounds, Fuels, Phenols, Photosynthesis, Tracers, Radiochemical analysis, Inhibition, Metabolism, Aromatic hydrocarbons, Quinones, *Selenastrum, *Synthetic fuels, Aromatic amines, Azarenes, Thiophenes, Aniline, Naphthylamine, Naphthol.

This paper presents results of experiments on the effects of aromatic compounds on photosynthesis in a freshwater alga. The classes tested were unsubstituted aromatic hydrocarbons, aromatic quinones, aromatic amines, methylated aromatics, phenols, azaarenes, and thiophenes. Each toxicant was tested at three concentrations, with two replicates per concentration. Photosynthesis was determined by measurement of carbon-14 fixation. Benzoquinone and naphthoquinone were the most toxic compounds tested. Anthraquinone, presumably due to its insolubility, was essentially nontoxic to S. capricornutum, as were all of the ot her 3-ring compounds except acridine. Aromatic amines (aniline and naphthylamine) were highly toxic, as was naphtnol. Thiophenes and azarenes were only slightly toxic except at the highest concentrations. The other classes of aromatic compounds were intermediate in toxicity. In all cases, 2-ring compounds were more toxic than related 1-ring compounds. Results on the relative toxicities of the compounds tested are in agreement with previously published results, in the few instances where comparisons are possible. (D-EIS)
W80-01072

EFFECT OF SELECTED WATER TOXICANTS AND OTHER CHEMICALS UPON ADENOSINE TRIPHOSPHATASE ACTIVITY IN VITRO,
Environmental Research Lab. Duluth, MN.
B. Riedel, and G. Christensen.

Bulletin of Environmental Contamination & Toxicology, Vol 23, p 365-368, 1979. 1 Tab, 27 Ref.

Descriptors: *Inhibition, *Enzymes, *Analytical techniques, Heavy metals, *Mercury, *Copper, *Cadmium, Pesticide toxicity, *DDT, *Dieldrin, *Nickel, *Cobalt, *Aluminum, Chemical properties, Salts, Chemical analysis, Metabolism, *Silver, *Lindane, *Malathion, *Carbaryl, *Ouabain.

Nineteen selected chemicals from structurally different chemical classes, most of them water pollutants, were studied for inhibitory effects on ATPase. The test chemicals used in this study were (reagent grade): AgNO3, CuC12, (CdC12.2H2), A1C13, NiC12.6H2O, CoC12.6H2O, NaC1, Na2S, NaF, CH3HgC1, malathion, carbaryl, lindane, dieldrin, DDT, dicofol, ouabain, and eserine (physostigmine). Salts of Ag+1, Hg+2, Cu+2, and Cd+2 were the most inhibiting chemicals to the enzyme. Of the pesticides studied, the arylorganochloride pesticide dicofol was the strongest inhibitor, followed by DDT, dieldrin, lindane, carbaryl, and malathion. The carbamate eserine was unreactive. Ouabain, considered a potent inhibitor of Na+1/K+1-ATPase, was about 375 times less reactive than Ag+1. An intermediate effect on activity was found for A1+3, F-1, Ni+2, and Co+2. No measureable effect was discernible for S-2 and NaC1. The toxic effect of heavy metal salts and some of the organometals and organochlorine pesticides might be caused by interruptions of energy-mobilizing and sensory-transmitting systems, of which ATP and its associated enzymes are an integral part. It seems unlikely that the organophosphate and carbamate pesticides exert a primary deleterious effect through ATPase inhibition, although a long exposure time and a high degree of bioaccumulation, coupled with a low rate of metabolic degradation could ultimately bring about an effect. (Deal-EIS)
W80-01073

MIREX RESIDUES IN EGGS AND LIVERS OF TWO LONG-LIVED REPTILES (CHRYSEMYS SCRIPTA AND TERRAPENE CAROLINA) IN MISSISSIPPI, 1970-1977,
Mississippi Univ. for Women, Columbus. Dept. of Physical Sciences.
C. M. Holcomb, and W. S. Parker.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 369-371, 1979. 1 Tab, 5 Ref.

Descriptors: *Pesticide residues, *Turtles, *Path of pollutants, Reptiles, Growth stages, Insecticides, Chlorinated hydrocarbon pesticides, Chemical analysis, Gas chromatography, Pesticide kinetics, Trophic level, *Tissue analysis, *Bioaccumulation, *Mirex.

Animals for the study were obtained from a location that received four applications of mirex over eight years at a concentration of 5% for fire ant control. Specimens were collected in 1970, 1972, 1974, 1975, and 1977. Significant levels of mirex were detected in both livers and eggs of both species of turtle. Mirex residues were consistently higher in livers of ox turtles than in sliders, and to a lesser extent in eggs as well. Peak residues in livers of both species occurred in 1972, 2.5 years after the last application of mirex bait. Residues declined after 1972, despite an application in 1974 which had no apparent effect on residues in sliders in 1977. (Deal-EIS)
W80-01074

OIL CHANGE IN EXCRETORY PRODUCTS OF MUSSELS (MYTILUS GALLOPROVINCIALIS),
Institute of Biology of the South Seas, Sevastopol (USSR).
O. G. Mironov, and T. L. Shchekaturina.
Marine Pollution Bulletin, Vol 10, p 232-234, 1979. 2 Fig, 4 Tab, 7 Ref.

Descriptors: *Oil, *Biodgradation, *Mussels, Animal metabolism, Animal physiology, Path of pollutants, Aromatic compounds, Organic compounds, Chemical analysis, Biochemistry, Gas chromatography, *Mytilus, *Tissue analysis, *Aliphatic compounds.

Oil ingested by mussels appears in the feces and pseudo-feces but differs in composition from the oil to which the animals are exposed. It contains more heavy fractions and larger aromatics, and there is a shift of aliphatic hydrocarbons towards heavier alkanes and isoprenoids. There is evidence that these changes are the result of metabolic processes in the mussels. (Deal-EIS)
W80-01075

SEDIMENT PENETRATION OF AMOCO CADIZ, OIL, POTENTIAL FOR FUTURE RELEASE, AND TOXICITY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
J. H. Vandermeulen, D. E. Buckley, E. M. Levy, B. F. N. Long, and P. McLaren.
Marine Pollution Bulletin, Vol 10, p 222-227, 1979. 5 Fig, 1 Tab, 15 Ref.

Descriptors: *Oil, *Toxicity, *Oil spills, Oil pollution, Path of pollutants, Sediments, Bottom sediments, Beaches, Chemical degradation, Chemical properties, Particle size, Sands, *Crude oil, *Amoco Cadiz.

Weathering states of oil ranging from sheen oil to mousse have significant effects during oil stranding on oil-water and oil-sediment interaction. Observations of oiled sandy beaches suggest two mechanisms of beach contamination--general penetration and contamination of beach substrate by films of sheen oil (probably partially emulsified), and secondly the burial of discrete layers of mousse. Depending on timing of oiling with respect to beach dynamics large amounts of stranded oil can be accommodated within beach sediments. These then become available for later long-term release. Acute lethal toxicity of stranded Amoco Cadiz oil is intermediate to Bunker C and Kuwait crude. Simulated weathering studies suggest that there may be some increase in toxicity with weathering. (Deal-EIS)
W80-01076

CELLULAR RESPONSES TO POLYCYCLIC AROMATIC HYDROCARBONS AND PHENOBARBITAL IN MYTILUS EDULIS,
Institute for Marine Environmental Research, Plymouth (England).
M. N. Moore.
Marine Environmental Research, Vol 2, p 255-263, 1979. 1 Fig, 2 Tab, 27 Ref.

Descriptors: *Mussels, *Enzymes, *Aromatic compounds, *Toxicity, Cytological studies, Animal metabolism, Animal physiology, Mode of action, Biochemistry, Analytical techniques, Chemical analysis, *Phenobarbital, *Phenanthrene, *Naphthalenes, *Mytilus, *Tissue analysis.

Certain polycyclic aromatic hydrocarbons and phenobarbital induced an increase in the activity of microsomal NADPH neoterazolium reductase in the blood cells of Mytilus edulis. Phenanthrene and methylated naphthalenes caused lysosomal destabilisation which is believed to be directly related to the mechanism of cytotoxicity in the digestive cells. The use of these cytochemical techniques as indices of aromatic hydrocarbon contamination is discussed. Among the hydrocarbons tested are naphthalenes and phenanthrene. (Deal-EIS)
W80-01077

THE RELATIONSHIP BETWEEN THE COPPER COMPLEXING CAPACITY OF SEA WATER ND COPPER TOXICITY IN SHRIMP ZOEAE,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
J. S. Young, J. M. Gurtisen, C. W. Apts, and E. A. Crecelius.
Marine Environmental Research, Vol 2, p 265-273, 1979. 2 Fig, 2 Tab, 14 Ref.

Descriptors: *Copper, *Toxicity, *Shrimp, *Growth stages, Larval growth stage, Mortality, Growth rates, Inhibition, Electrochemistry, Ions, Chemical analysis, Complexing capacity, *Tissue analysis, *Bioaccumulation, *Pandalus.

Mortality of larval coon-stripe shrimp, Pandalus danae, was related to labile copper and the copper complexing capacity of sea water, as measured by differential pulse Anodic Stripping Voltammetry (ASV). In nominal treatments of control, 5 and 10 microg/litre Cu which contained less than 1.0 microg/litre ASV labile Cu, zoeal development was usually complete. In treatments of 20 and 50 microg/litre Cu which contained more than 7.0 microg/litre ASV labile Cu, most larvae died while in the first zoeal stage. ASV labile Cu was related to the copper complexing capacity of sea water. Copper toxicity at less than 1.0 microg/litre ASV labile Cu is indicated by moulting delay and apparent Cu accumulation in zoea of the 5 and 10 microg/litre Cu nominal treatments. (Deal-EIS)
W80-01078

FAILURE OF OSMOREGULATION WITH APPARENT POTASSIUM. INTOXICATION IN MARINE TELEOSTS: A PRIMARY TOXIC EFFECT OF COPPER,
Florida, Univ., Gainesville. Coll. of Veterinary Medicine.
P. T. Cardeilhac, C. F. Simpson, R. L. Lovelock, S. F. Yosha, and H. W. Calderwood.
Aquaculture, Vol 17, p 231-239, 1979. 5 Fig, 1 Tab, 16 Ref.

Descriptors: *Copper, *Toxicity, *Osmosis, Fish physiology, Membrane processes, Potassiu, Fish behavior, Mortality, Chemical analysis, Chemical properties, Phosphates, Teleosts, Fish diseases, Mode of action, *Sheepshead, *Archosargus, *Tissue analysis.

Four sheepshead, Archosargus prob atocephalus, were exposed to toxic concentrations, (8.5 ppm) of cupric ion (copper) in sea water. Five stages of intoxication of increasing severity, based on behavior and posture, were designated as follows: lethargy; indifference; incoordination; moribundity; death. Serum, gills, liver, and kidneys were taken from fish at different stages of intoxication for examination. Kidneys were congested and swollen, the kidney wt/body wt index increasing up to 13.5 standard deviations (S.D.) over the mean control value. Gill lamellae from copper-poisoned fish were blunt and thickened, capillaries congested, and mucous cells dilated. Livers were similar to controls. Twenty-two clinical values were examined but only serum electrolytes and uric acid levels, liver and gill copper concentrations, kidney weights, and respiratory rates increased in poisoned fish by more than 5 S.D. over mean control values and correlated with the different stages of intoxication. Increased serum potassium, inorganic phosphate, and total intracellular ion values gave highest correlations with severity of intoxication. Potassium levels reached values considered lethal for mammals, and it was concluded that the intoxication following copper poisoning was a potassium intoxication caused primarily by cell damage and failure of osmoregulation by the gills and kidneys. (Deal-EIS)
W80-01079

THE RESPIRATORY RESPONSE OF JUVENILE MUD CRABS, RHITHROPANOPEUS HARRISII TO VARIATIONS IN SALINITY AND FOLLOWING SHORT-TERM EXPOSURE TO HALOWAX 1099, A POLYCHLORINATED NAPHTHALENE (PCN),
Texas A and M Univ., College Station. Dept. of Biology.
R. B. Laughlin, Jr., and J. M. Neff.
Marine Environmental Research, Vol 2, p 275-286, 1979. 4 Fig, 1 Tab, 47 Ref.

Descriptors: *Crabs, *Toxicity, *Organic compounds, *Salinity, Chemical wastes, Chemical properties, Animal behavior, Animal physiology, Respiration, Osmosis, Crustaceans, Desalination processes, Salt tolerance, Animal metabolism, Mode of action, *Polychlorinated naphthalene, *Naphthalenes.

Juvenile mud crabs were exposed for five days to Halowax 1099, a polychlorinated naphthalene (approximately 1:1 ratio of tri- and tetrachlorinated isomers). Exposure concentrations were 0, 20, 50

or 100 microg/litre. The exposure salinity was 15 o/oo. At the end of the exposure period, respiratory rates of the crabs were determined at 15 o/ooS. The respiratory rates were also determined for control and exposed animals which were osmotically shocked by a move from 15 o/ooS to either 5 or 25 o/ooS immediately before respirometry. Exposure to PCNs always caused the mean respiratory rates of juvenile crabs to increase over control values. The respiratory response of crabs to PCN exposure was similar at the steady-state salinity (15 o/ooS) and after hyperosmotic shock (25 o/ooS). However, the mean rate for animals exposed to PCNs and given a hyposmotic shock was significantly higher than that for controls and for PCN-exposed animals at the other two salinities. Since hyperosmotic regulation of body fluids is most active at low salinities in this species, we suggest that the PCNs interfere with hyperosmotic regulation and reduce the efficiency of metabolic compensation for hyposmotic shock. The higher energetic cost of acclimation to transient reductions in salinity would be potentially detrimental to wild populations in impacted areas. (Deal-EIS)
W80-01080

EFFECTS OF LOGGING ON STREAM ENVIRONMENTS AND FAUNAS IN NELSON,
Marine Dept., Wellington (New Zealand). Fisheries Research Div.
E. Graynoth.
New Zealand Journal of Marine and Freshwater Research, Vol 13, No 1, p 79-109, 1979. 12 Fig, 12 Tab, 91 Ref.

Descriptors: *Lumbering, *Forest management, Streams, Habitats, Clear-cutting, Runoff, Watershed management, Erosion, Stream erosion, Accelerated erosion, Benthic fauna, Diptera, Brown trout, Mayflies, Aquatic insects, *New Zealand, Oligochaetes, Sediments, Water temperature, Stone flies.

The effects of various logging practices on stream environments and faunas were studied at the Golden Downs State Forest in Nelson. Comparisons were made between the features of a control stream with an unmodified forest catchmen and three streams whose catchments had been affected by different logging practices. Measurements were made of stream flow, water temperature, stream bed sedimentation, suspended sediment and dissolved solids concentrations, and the abundance of benthic invertebrates and fishes. Clearfelling to the stream's edge, together with inappropriate roading and bridging techniques, caused great changes in stream environments and faunas. Excessive amounts of waste timber and soil entered streams and stream bed loads, and suspended sediment and dissolved soil concentrations increased. In comparison to the control stream water temperatures increased in summer by up to 6.5C and decreased in winter by as much as 2.5C. In one stream the benthic invertebrate fauna was greatly modified; there was a reduction in the abundance of Plecoptera and certain Ephemeroptera nymphs, and an increase in the abundance of oligochaetes, chironomids, and Deleatidium nymphs. Fishes, Galaxias divergens and Anguilla dieffenbachi, were also reduced in numbers in this stream. (Deal-EIS)
W80-01081

PREDICTING ROTENONE DEGRADATION IN LAKES AND PONDS,
New York State Dept. of Environmental Conservation, Albany.
R. Engstrom-Heg, and R. T. Colesante.
New York Fish and Game Journal, Vol 26, No 1, p 22-36, 1979. 5 Fig, 1 Tab, 9 Ref.

Descriptors: *Rotenone, Chemical degradation, Pesticide kinetics, Chemical properties, Water temperature, Pesticide toxicity, Piscicides, Light penetration, Fish management, Lakes, Epilimnion, Hypolimnion, Rotenone degradation.

The rate of natural degradation of rotenone in a lake was estimated by suspending rotenone solutions at a series of depths in clear and opaque plastic bags. Logarithms of rate constants for all deep samples and for surface and epilimnetic samples in opaque bags were proportional to temperature. Light plays an important role in detoxification of surface waters. Equations were developed for estimating detoxification times and appropriate treatment dates in relation to the fall overturn for lakes and ponds under a variety of conditions. (Deal-EIS)
W80-01082

AN INVESTIGATION INTO THE EFFECTS OF THE PISCICIDE ANTIMYCIN A ON THE FISH AND INVERTEBRATES OF A SCOTTISH STREAM,
Freshwater Fisheries Lab., Pitlochry (Scotland).
B. R. S. Morrison.
Fisheries Management, Vol 10, No 3, p 111-122, 1979. 1 Fig, 2 Tab, 21 Ref.

Descriptors: *Antimycin A, *Pesticide toxicity, *Trout, Piscicides, Invertebrates, Streams, Benthic fauna, Aquatic insects, Diptera, Mollusks, Fish populations, Salmonids, Aquatic populations, Mayflies.

Field treatments are described in which the effects of antimycin A on fish and invertebrates in a highland stream were studied. Because of the limited extent of the fish kill during the first treatment in 1976, a second treatment was undertaken the following year when the exposure period was increased from 2 h to 5 and 6 h. The water level in both years was very low, generally only a few centimetres deep, but a concentration of 10 microg/l antimycin killed wild fish and the control fish which were held in cages in different parts of the stream. A significant decrease was noted in the numbers of Ecdyonurus spp. at one of the sampling sites after the 1976 treatment, and of Paraleptophlebia submarginata (Steph.) at one site after the 1977 treatment. No significant decrease was found in the populations of the other species collected after each treatment. It is concluded that trout populations in streams can be controlled effectively by antimycin applied at a concentration of 10 micro/l, provided the exposure period lasts for several hours. Antimycin does not appear to have an adverse effect on the invertebrate fauna as a whole. (Deal-EIS)
W80-01083

THE EFFECT OF AMMONIA ON THE GROWTH OF JUVENILE DOVER SOLE, SOLEA SOLEA (L.) AND TURBOT, SCOPHTHALMUS MAXIMUS (L.),
Ministry of Agriculture, Fisheries and Food, Port Erin (England). Fisheries Lab.
R. Alderson.
Aquaculture, Vol 17, p 291-309, 1979. 6 Fig, 5 Tab, 39 Ref.

Descriptors: *Ammonia, *Toxicity, *Growth rates, Fish physiology, Animal metabolism, Juvenile growth stage, Water chemistry, Ions, Hydrogen ion concentration, Sea water, Aquiculture, Fish management, Fish diseases, Chemical properties, *Turbot, *Scophthalamus, *Sole, *Solea, *Tissue analysis.

The growth of sole and turbot was followed in groups of fish exposed to constant unionised ammonia concentrations at pH levels both at and below that of normal sea water. Low pH levels were produced by the addition of carbon dioxide. Results for both species showed evidence for a threshold level of unionised ammonia below which little or no effect on growth was evident. This level was determined to be 0.066 mg N/1 for sole and 0.11 mg N/1 for turbot at 16C, 34o/oo salinity. The different pH conditions did not have any marked effect on these threshold levels. Above the threshold levels growth appeared to be depressed in a linear manner with increased unionised ammonia. The rate at which growth was depressed was greatest at the low pH levels for both species. The level at which growth ceased thus decreased from 0.77 to 0.38 mg N/1 for sole and from 0.9 to 0.3 mg N/1 for turbot, over the pH range from 7.9 to 6.9. The absence of disease and gill damage in the experimental populations is discussed. It is suggested that this and the tolerance shown by the fish, which is higher than is generally accepted for fish in high density culture, may be due to the clean environment in which the fish were held while under test. (Deal-EIS)
W80-01084

TOLERANCE OF DEVELOPING SALMONID EGGS AND FRY TO NITRATE EXPOSURE,
Fish and Wildlife Service, Portland, OR. Div. of Ecological Services.
J. W. Kincheloe, G. A. Wedemeyer, and D. L. Koch.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 575-578, 1979. 2 Tab, 4 Ref.

Descriptors: *Fish eggs, *Toxicity, *Nitrates, Fish management, Fish physiology, Growth stages, Fry, Water chemistry, Hardness(Water), Salmonids, Chinook salmon, Sockeye salmon, Rainbow trout, Cutthroat trout, Fish reproduction.

A series of tests were designed to develop guidelines for allowable nitrate exposure in waters of low total hardness needed to protect the egg and early fry stages of chinook and coho salmon; anadromous (steelhead) and nonanadromous rainbow trout, and Lahontan cutthroat trout, a threatened species. Nitrate at 5-10 mg/L is mildly toxic to developing eggs and the early fry stages of rainbow and steelhead trout. Chinook salmon and Lahontan cutthroat trout were affected only at exposure levels of 20 mg/L or higher. Coho salmon were sufficiently resistant so that nitrate exposure at the tested levels during incubation will probably not be of concern. Thus, as a guideline, nitrate at levels of 10 mg/L (2 mg/L NO3-N) in surface waters of low total hardness would be expected to limit survival of some salmonid fish populations because of impaired reproductive success. In the case of soft-water reuse hatcheries using biological nitrification, egg incubation in recycled water should be done with caution. Additional work is needed to determine the point in fry development at which tolerance to nitrate begins to increase to adult levels. (Deal-EIS)
W80-01085

RECOVERY OF 14C-LABELLED POLYCHLORINATED BIPHENYLS (PCB) IN FISH TISSUE USING A COMBUSTION AND A SOLUBILIZATION METHOD OF SAMPLE PREPARATION FOR SCINTILLATION ANALYSIS,
Canada Centre for Inland Waters, Burlington (Ontario),
A. J. Niimi, and G. A. Burnison.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 597-600, 1979. 1 Tab, 13 Ref.

Descriptors: *Analytical techniques, *Pollutant identification, *Radiochemical analysis, Polychlorinated biphenyls, Aroclors, Rainbow trout, Daphnia, Chlorella, Tracers, Carbon radioisotopes, Methodology, Chemical analysis, *Liquid scintillation analysis, *Tissue analysis.

Liquid scintillation analysis for 14C in most biological materials require some preparation to render the sample suitable for counting. Use of a tissue solubilizer is by far the most common practice, although an oxidative combustion method has been used. This study evaluated the two methods to determine if one was more desirable than the other. 14C-labelled Aroclor 1242 was incorporated into the tissues of rainbow trout through a laboratory food chain. Samples of trout were then analyzed using either the oxidation combustion process or the tissue solubilizer (NCS) method. For most replicates, no significant differences in the mean recovery level was demonstrated between two treatments at PCB tissue concentrations of 2-7600 ng/g. This was due in part to the large variations of the NCS treated samples at PCB concentrations below 220 ng/g. The oxidative combustion method was able to measure the labelled compound in the pg/g range, while the NCS treatment was not able to consistently provide measurements above background levels. (Deal-EIS)
W80-01086

IDENTIFICATION OF TRANS-NONACHLOR IN GOBY-FISH FROM TOKYO BAY,

Tokyo Metropolitan Research Lab. of Public Health (Japan).
T. K. Miyazaki, K. Akiyama, S. Kaneko, S. Horii, and T. Yamagishi.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 631-635, 1979. 2 Fig, 13 Ref.

Descriptors: *Pesticide residues, *Pollutant identification, *Gas chromatography, Chlorinated hydrocarbon pesticides, DDE, Polychlorinated biphenyls, Chemical analysis, Chemical properties, Spectrophotometry, Laboratory tests, *Nonachlor, *Tissue analysis, *Bioaccumulation, *Chlordane, *Heptachlor.

During gas chromatographic analysis of goby-fish for pesticide residue an unknown peak was noted. The behavior of this compound, identified as trans-nonachlor, under several chemical test is described. This is the first identification of this compound in environmental biota in Japan. The approximate level of trans-nonachlor in fish examined was 18 ppb as compared to 29 ppb DDE and 670 ppb PCBs. (Deal-EIS)
W80-01087

BIOLOGICAL AVAILABILITY OF SEDIMENT-BOUND CADMIUM TO THE EDIBLE COCKLE, CERASTODERMA EDULE,
Bristol Univ. (England). Dept. of Inorganic Chemistry.
M. Cooke, G. Nickless, R. E. Lawn, and D. J. Roberts.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 381-386, 1979. 1 Tab, 13 Ref.

Descriptors: *Cadmium, *Absorption, *Crustaceans, Calcium carbonate, Iron, Manganese, Oxides, Chemical properties, Chemical precipitation, Heavy metals, Path of pollutants, Spectrophotometry, Zinc, *Tissue analysis, *Bioaccumulation, *Bioavailability, *Cockle, *Cerastoderma.

The biological availability of cadmium (present as Cd2+) to the edible cockle, Cerastoderma edule, from the four sediments: iron oxide; manganese oxide, calcium carbonate and biogenic calcium carbonate was investigated. Cadmium bound to biogenic calcium carbonate is readily available to C. edule but cadmium bound to precipitated calcium carbonate is of considerably lower bio-availability. Cadmium bound to iron oxide and manganese oxide is unavailable, at least in short term exposures. Availability appears to be determined by the ability of the metal to desorb from the sediment. (Deal-EIS)
W80-01088

EXTRACTION AND GAS-LIQUID CHROMATOGRAPHIC ANALYSIS OF CHLORPHOXIM IN WATER AND FISH,
Center for Disease Control, Atlanta, GA. Environmental Health Services, Div.
L. H. Zakitis.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 391-397, 1979. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Analytical techniques, *Gas chromatography, *Organophosphorus pesticides, Laboratory tests, Chemical analysis, Chemical reactions, Sunfishes, Pesticide kinetics, Insecticides, Pollutant identification, *Chlorphoxim, *Tissue analysis.

Using the basic principle of transesterification by methoxide ion, a gas chromatographic method has been developed for the analysis of chlorphoxim which increases the efficiency of conversion to DEMTP by eliminating undesirable side reactions and thus reducing the time required for GLC analysis to about 3 min. The proposed method has the further advantage of allowing analysis of fish extracts without additional cleanup. To evaluate the effectiveness of the extraction method bluegill fish were exposed to known concentrations of chlorphoxim. Recovery of chlorphoxim from tissue samples averaged 83+ or -15%. The method was also effective in determining levels of chlorphoxim in water. (Deal-EIS)
W80-01089

AN EVALUATION OF THE ACUTE TOXICITY TO AQUATIC BIOTA OF A COAL CONVERSION EFFLUENT AND ITS MAJOR COMPONENTS,
Oak Ridge National Lab., TN.
B. R. Parkhurst, A. S. Bradshaw, J. L. Forte, and G. P. Wright.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 349-356, 1979. 4 Tab, 10 Ref.

Descriptors: *Fuels, *Toxicity, *Daphnia, Coals, Organic compounds, Bioassay, Phenols, Ammonia, Sulfates, Nitrates, Phosphates, Chemical waste, Chemical properties, Coal conversion effluent, *Synthetic fuels, *Coal conversion, *Cresols.

This paper describes a systematic evaluation of the potential acute toxicity to aquatic organisms of aqueous wastes from a coal conversion process. Two types of aqueous wastes were analyzed: treated and untreated. The untreated waste had much higher concentrations of phenol, cresols, ammonia, and total organic carbon, while the treated waste had higher concentrations of sulfate, nitrate, phosphate, and thiocyanate. The toxicity (48-h LC50) of each component was determined for Daphnia magna. The most toxic components were the cresols followed by phenol, ammonia, and thiocyanate. Nitrate, phosphate, and sulfate were relatively nontoxic. (Deal-EIS)
W80-01090

EFFECTS OF CHRONIC EXPOSURE TO ZINC ON REPRODUCTION IN THE GUPPY (POECILIA RETICULATA),
Alberta Univ., Edmonton. (Canada) Dept. of Zoology.
E. J. Uviovo, and D. D. Beatty
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 650-657, 1979. 3 Fig, 1 Tab, 30 Ref.

Descriptors: *Toxicity, *Zinc, *Fish reproduction, Size, Growth stages, Fish physiology, Mode of action, Bioindicators, Heavy metals, Mortality, Fecundity, Zooplankton, *Guppy, *Poecilia

The investigation was undertaken to examine the effects of chronic exposure to sublethal levels of zinc on reproduction in the guppy, Poecilia reticulata. Fish were exposed to either 0.36, 0.88, or 1.70 microg/L zinc for four months. Reproductive data collected included brood size, time between broods, and the size and condition of young at birth. Zinc had no effect on the interval between broods. Brood size was decreased 24, 58 and 50%, respectively, at the three zinc concentrations. In all zinc concentrations, dead young were produced, a condition not observed in controls. Live young in the two larger zinc exposure groups were significantly smaller than control or the low-exposure group. The results indicated that these parameters are very sensitive indicators of zinc. (Deal-EIS)
W80-01091

BENZO(A)PYRENE CONCENTRATIONS IN MUSSELS (MYTILUS EDULIS) FROM YAQUINA BAY, OREGON DURING JUNE 1976-MAY 1978,
Oregon State Univ., Corvallis. Dept. of General Science.
M. C. Mix, and R. L. Schaffer.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 677-684, 1979. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Aromatic compounds, *Mussels, *Absorption, Oil, Oil pollution, Organic compounds, Bioindicators, Monitoring, Chemical analysis, Path of pollutants, Animal physiology, Creosote, Seasonal, Yaguina Bay, Oregon, *Benzo(a)pyrene, *Tissue analysis, *Bioaccumulation.

The purposes of this study were to measure benzo(a)pyrene (BAP) concentrations in indigenous populations of mussels for a two-year period, determine seasonal fluctuations in BAP body burdens, and analyze factors that may influence temporal concentration patterns. Mussels were collected bimonthly from 13 sites. BAP concentrations varied considerably in mussels from different geographical sites and during different times of the year. There were general seasonal differences in BAP body burdens that may have been associated with increases in environmental BAP, intrinsic physiological factors and/or the effects of exogenous factors on polynuclear aromatic hydrocarbon uptake and incorporation. Although the sources of BAP are not yet known, it is felt that point sources such as creosoted pilings, marinas, fish processing factories and boat traffic, contributed. (Deal-EIS)
W80-01092

PCB RESIDUES IN BIVALVES AND SEDIMENTS OF RARITAN BAY,
Industrial Environmental Research Lab.-Cincinnati, Edison, NJ
D. Stainken, and J. Rollwagen.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 690-697, 1979. 4 Fig, 1 Tab, 12 Ref

Descriptors: *Polychlorinated biphenyls, *Aroclors, *Pesticide residues, Oysters, Clams, Shellfish, Chemical analysis, Bottom sediments, Path of pollutants, DDE, Mollusks, Gas chromatography, Chlorinated hydrocarbons pesticides, Benthic fauna, Hudson River, Raritan Bay, *Tissue analysis, *Bioaccumulation.

This study reports the results of a survey of PCB contamination in the Raritan Bay-Lower New York Bay complex. Sediments and bivalve populations were analyzed to determine quantities and types of PCB compounds present. The range of residues in all bivalve tissues was found to be 12-360 ng/g tissue. The mean values found per species sampled were C. virginica 81 + or -32 ng/g tissue, M. arenaria 149 + or - 67 ng/g tissue and M. mercenaria 131 + or - 27 ng/g tissue. In contrast, the range of residues in sediments was 3.4-2035 ng/g. Very few sediment retention times matched more than 70% with the standard mix of Aroclors. However, many sediments matched more than 50% with the individual Aroclors. The sediments appear to contain mixtures of various homologs of the Aroclors. Mixtures of Aroclors 1016 and 1242 appeared to occur in all sediments, Aroclor 1260 occurred frequently and 1254 less often. (Deal-EIS)
W80-01093

EFFECTS OF ALUMINUM AND NICKEL ON SURVIVAL AND REPRODUCTION IN POLYCHAETOUS ANNELIDS,
California State Univ., Long Beach. Dept. of Biology
S. M. Petrich, and D. J. Reish.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 698-702, 1979. 2 Tab, 21 Ref.

Descriptors: *Nickel, *Aluminum, *Toxicity, *Polychaetes, Reproduction, Inhibition, Bioassay, Metals, Animal physiology, Mode of action, Chlorides, Chemical wastes, *Neanthes, *Capitella, *Ctenodrilus.

The purpose of this investigation was to determine the acute effects of the chlorides of aluminum and nickel on the survival of three species of polychaetes and, in addition, to observe any effects on reproduction in one species having a short life history. The 96-h and 7-day LC 50 values for aluminum chloride and nickel chloride were determined for Capitella capitata; Ctenodrilus serratus; and Neanthes arenaceodentata. Capitella was the most tolerant of the three species and Ctenodrilus the most sensitive to these two metals. No reproductive suppression was produced in Capitella and Neanthes at maximum possible concentrations (2 mg/L). The results indicated that aluminum is more toxic than nickel to these polychaetes, but the concentration at which reproductive suppression occurs in Ctenodrilus is similar in both metals. (Deal-EIS)
W80-01094

TOXICITY OF SODIUM PENTACHLOROPHENATE TO JUVENILE CHINOOK

SALMON UNDER CONDITIONS OF HIGH LOADING DENSITY AND CONTINUOUS-FLOW EXPOSURE,
British Columbia Dept. of Recreation and Conservation, Victoria. Fish and Wildlife Branch.
G. K. Iwama, and G. L. Greer.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 711-716, 1979. 1 Fig, 11 Ref.

Descriptors: *Sodium compounds, *Toxicity, *Chinook salmon, Juvenile growth stage, Bioassay, Salmonids, Organic compounds, Fish physiology, Mortality, Analytical techniques, Bioassay, *Sodium pentachlorophenate.

This study reports the results of a bioassay to determine the flow-through 96h LC50 of sodium pentachlorophenate for juvenile chinook salmon at a specified loading density. The incipient 96 h LC50 of NaPCP for juvenile chinook salmon at a loading density of 13.8 g/l was 0.078 mg/l; the 95% confidence limits were 0.057 and 0.110 mg/l. The control fish appeared normal during the 2 weeks of acclimatization to the test tanks and throughout the bioassay period. The NaPCP 96 h LC50 obtained in this continuous-flow bioassay lies in the mid-range of 96 h LC50 values determined for related species of juvenile salmonids by static method in an interlaboratory bioassay standardization study. (Deal-EIS)
W80-01095

HATCHING SUCCESS AND LARVAL MORTALITY IN AN ESTUARINE TELEOST, MENIDIA MENIDIA (LINNAEUS), EXPOSED TO CADMIUM IN CONSTANT AND FLUCTUATING SALINITY REGIMES,
Environmental Research Lab., Narragansett, RI.
R. A. Voyer, J. F. Heltsche, and R. A. Kraus.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 475-781, 1979. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Cadmium, *Salinity, *Toxicity, *Fish eggs, Salt tolerance, Heavy metals, Fish reproduction, Fish physiology, Mortality, Water chemistry, Growth stages, *Menidia.

In view of cyclic fluctuations in salinity that may accompany tidal changes in an estuary, it was decided to determine the influence of a periodic, fluctuating salinity regime on the hatching success of Menidia embryos exposed to cadmium and on the survival of resulting larvae and to compare these responses with those of embryos and larvae exposed to cadmium at a number of fixed salinities. Menidia were exposed to three levels of cadmium (plus control) at one fluctuating (10-30 o/oo) and three stable (10, 20, 30 o/oo) salinities. Percentage of larval mortality at the constant salinities was higher among larvae from cadmium-exposed eggs than in control treatments, and was consistently greatest at 10 o/oo and least at 30 o/oo salinity. Mean concentrations of cadmium lethal to 50% of the larvae from cadmium-exposed eggs in the two experiments were 0.15, 0.63, and 1.12 mg/l at salinities of 10, 20, and 30 o/oo, respectively. Mean total hatches in cadmium-treated eggs in the fluctuating salinity regime averaged at least 90% in each of the two low metal concentrations and was about 70% at the high cadmium concentration. (Deal-EIS)
W80-01096

EFFECT OF BARITE ON MEIOFAUNA IN A FLOW-THROUGH EXPERIMENTAL SYSTEM,
Texas Instruments Inc., Buchanan, NY.
F. R. Cantelmo, M. E. Tagatz, and K. R. Rao.
Marine Environmental Research, Vol 2, p 301-309, 1979. 3 Tab, 37 Ref.

Descriptors: *Bioassay, *Drilling fluids, *Mud, Bottom sediments, Benthic fauna, Dominant organisms, Biological communities, Biomass, Depth, Rotifers, Polychaetes, Copepods, Nematodes, Barium sulfate, *Barite, *Foraminifera, *Hydrozoa, *Turbellaria, *Ostracoda.

The effects of barite (94-96% BaS04), a major constituent of drilling muds used in marine oil drilling operations, on meiofauna were studied in an experimental flow-through system. Aquaria containing sand or varying proportions of barite and sand received a continuous supply of unfiltered seawater from Santa Rosa Sound, Florida, for ten weeks. At the end of this period the composition, biomass and vertical distribution of the meiofauna were determined. Most of the meiofauna (>99%) occurred in the highly aerobic upper 2 cm portion of the substratum. Rotifera, Foraminifera, Hydrozoa, Turbellaria, Ostracoda, Polychaeta and Bivalvia did not exhibit significant differences between control and experimental aquaria. However, the densities of Nematoda, Copepoda and Copepoda nauplii varied with the substrate composition. The meiofaunal densities in the aquaria containing 1:10 or 1:3 mixtures of barite and sand were greater than that in aquaria containing sand alone. A marked decrease in meiofaunal density was evident in aquaria containing 5.5 cm of sand covered with a 0.5 cm layer of barite. (Deal-EIS)
W80-01097

SUBLETHAL EFFECTS OF HEAVY METAL CONTAMINATED SEDIMENTS ON THE BIVALVE MACOMA BALTHICA (L.),
British Columbia Univ., Vancouver. Inst. of Oceanography.
E. R. McGreer.
Marine Pollution Bulletin, Vol 10, p 259-262, 1979. 1 Fig, 4 Tab, 14 Ref.

Descriptors: *Toxicity, *Heavy metals, *Clams, Marine benthos, Mercury, Cadmium, Animal behavior, Animal physiology, Mode of action, Bioindicators, Bioassay, Benthic fauna, Bottom sediments, Methodology, *Macoma.

Sublethal effects of estuarine sediments containing high levels of heavy metals were studied using the marine bivalve, Macoma balthica. Burrowing behaviour was inhibited in all contaminated sediments compared to the control. The time required for 50% of the population to burrow (ET50) ranged from 0.17h in the control to 4.8h in the most contaminated substrate. A comparison of linear regressions of the concentrations of individual metals in the sediments vs the burrowing response times showed the regressions for mercury and cadmium to be significant. An active threshold avoidance response by burrowed M. balthica was also demonstrated as clams showed a significant avoidance of the sediment containing the highest metal levels. Both behavioural responses were considered useful sublethal tests to assess the impact of polluted sediments. (Deal-EIS)
W80-01098

MONITORING TRACE ELEMENTS IN THE MUSSEL, MYTILUS EDULIS USING X-RAY ENERGY SPECTROSCOPY,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Chemistry.
I. G. Stump, J. Kearney, J. M. D'Auria, and J. D. Popham.
Marine Pollution Bulletin, Vol 10, p 270-274, 1979. 4 Fig, 2 Tab, 21 Ref.

Descriptors: *Analytical techniques, *Trace elements, *X-Ray spectroscopy, Monitoring, Methodology, Chemical analysis, Mussels, Pollutant identification, Heavy metals, Path of pollutants, Manganese, Iron, Copper, Zinc, *Bioaccumulation, *Tissue analysis, Arsenic, Selenium, Lead.

X-ray energy spectroscopy has been successfully utilized to provide rapid, multi-elemental, quantitative analyses of the intertidal mussel, Mytilus edulis, found in southern coastal waters of British Columbia (Canada). Since no a priori decision needed to be made on which elements required monitoring, concentrations of the seven dominant elements (Mn, Fe, Cu, Zn, As, Se, and Pb) were determined in the gills and viscera of these organisms. The potential usefulness of XES for providing relevant data on aquatic bioaccumulators for environmental monitoring studies is discussed. (Deal-EIS)
W80-01100

THE EMBRYONIC DEVELOPMENT AND THE THERMAL EFFECTS ON THE DEVELOPMENT OF THE MOUNTAIN WHITEFISH, PROSOPIUM WILLIAMSONI (GIRARD),
Utah Cooperative Fishery Unit, Logan.
P. K. Rajagopal.
Journal of Fish Biology, Vol 15, p 153-158, 1979. 1 Fig, 1 Tab, 3 pl, 14 Ref.

Descriptors: *Growth rates, *Toxicity, *Water temperature, Embryonic growth stage, Growth stages, Mortality, Fish physiology, Fish reproduction, Adaptation, Larval growth stage, Thermal stress, Fish diseases, Animal pathology, *Whitefish, *Prosopium.

The general development of the mountain whitefish was similar to other whitefishes. Mountain whitefish required more thermal units to reach corresponding stages of the lake whitefish, after the stage when the blastodisc was prominently raised on the yolk. The development process was greatly disrupted and a heavy mortality of egs occurred when the temperature was raised to 9C or higher. In hatched larvae abnormalities like monomicrophthalmia, agape jaws, and coloboma occurred when the temperature was raised to 9C or higher, although the reported optimum temperature for growth of the post yolk sac larvae and juveniles was 9C-12C. The late spawned eggs exhibit adaptive mechanisms which enabled them to shorten the incubation time and hatch along with the early spawned eggs, when conditions for survival are at optimum. (Deal-EIS)
W80-01101

UPTAKE OF METHOXYCHLOR FROM FOOD AND WATER BY THE AMERICAN TOAD (BUFO AMERICANUS),
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
R. J. Hall, and D. Swineford.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 335-337, 1979. 1 Tab, 9 Ref.

Descriptors: *Absorption, *Chlorinated hydrocarbon pesticides, *Toads, Amphibians, DDT, Pesticide kinetics, Path of pollutants, Pesticide residues, Chemical analysis, Gas chromatography, Animal physiology, Animal metabolism, *Methoxychlor, *Tissue analysis, *Bioaccumulation.

Four groups of toads were maintained in the laboratory: two receiving methoxychlor in food (0.024 or 0.325 ppm); one in water (0.069 ppm); and one control. Toads fed 0.024 ppm methoxychlor in the diet accumulated residues averaging 0.010 ppm. Animals on the dietary dosage for one and six days showed no significant differences in accumulation. All toads fed 0.32 ppm prey had detectable residues; the mean was 0.033 ppm. Tissue levels averaged about 0.4 times the dietary level in the lower dosage groups and 0.11 times dietary concentrations in the higher dosage group. No residues were detected in the controls. Toads exposed to methoxychlor in water had mean residue in levels of 0.192 ppm or approximately 2.8 times the concentration measured in the water. Residue levels are not correlated with duration of exposure. No gross signs of pathology were seen during autopsies, nor were there changes in organ weights, feeding, behavior, or survival. (Deal-EIS)
W80-01102

TOTAL AND ORGANIC MERCURY IN MARINE FISH OF THE UPPER GULF OF THAILAND,
Chulalongkorn Univ., Bangkok (Thailand). Inst. of Environmental Research.
V. Cheevaparanapivat, and P. Menasveta.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 291-299, 1979. 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Mercury, *Trophic level, *Path of pollutants, Heavy metals, Crustaceans, Plankton, Marine fish, Food chains, Spectrophotometry, Chemical analysis, Weight, *Methylmercury, *Tissue analysis, *Bioaccumulation, *Thailand.

One hundred and ninety-one samples of 22 species of fish, 27 samples of 2 species of crustacean and 10

samples of plankton from the upper Gulf of Thailand were analysed for total and organic mercury. Total mercury concentrations were found ranging from 2 to 650 ppb with the mean value of 41 ppb. Organic mercury ranged from 0 to 280 ppb with the mean value of 23 ppb. Fish of higher trophic levels contained higher mercury residues than fish of lower trophic levels, which in turn had higher residue levels than the crustaceans and plankton. This suggests that mercury may be concentrated in the same manner as an organic compound such as the organochlorine pesticides. (Deal-EIS)
W80-01105

CHARACTERISTICS OF SPORT FISHING ACTIVITY IN THREE WARM WATER DISCHARGES,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries, and Wildlife Development.
R. W. Schneider, A. O. Smith, and V. P. Mitchell, Jr.
Proceedings of the Thirty First Annual Conference of South-East Fish & Wildlife Agencies, Vol 31, p 546-554, 1977. 5 Fig, 1 Tab, 13 Ref.

Descriptors: Water temperature, *Thermal power plants, *Thermal water, Water pollution effects, *Sport fishing, Wastewater disposal, Tennessee, Tennessee Valley Authority, Gallatin steam plant, Kingston steam plant, John Sevier steam plant, Cumberland River, Holston River, Clinch River, Fossil fuels, Sport fishing activity, Monitoring, Fish behavior, Channel catfish, Sunfish, Bass.

Creel surveys were conducted at TVA's Gallatin, Kingston, and John Sevier Steam Plant discharge basins from March 1975 through May 1976. The highest period of angler use at all plants occurred between April and June. Peak harvest and pressure in the 3 discharge basins were significantly related, and high periods usually occurred later in the year than has been reported from other areas. At least 18 species were found in the combined creel from the 3 plants, and species diversity was greatest during the warm months. Three species, channel catfish (Ictalurus punctatus) bluegill (Lepomis macrochirus), and white bass (Morone chrysops), comprised over 50% of the combined creel. Angler harvest remained uncommonly high from March through August with lowest levels observed in the winter months. The overall angler catch per hour (c/h) was 0.5 fish while the highest monthly c/h recorded was 2.3 at John Sevier in May 1975. It seemed that angler c/h reflected seasonal changes in the sport fish population, and it was concluded that the fishery could sustain a significant increase in pressure and harvest at certain times of the year. (Deal-EIS)
W80-01106

EFFECTS OF COREXIT 9527 ON THE HATCHABILITY OF MALLARD EGGS,
Fish and Wildlife Service, Laurel MD. Patuxent Wildlife Research Center.
P. H. Albers.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 661-668, 1979. 3 Tab, 23 Ref.

Descriptors: *Oil, *Toxicity, *Mallard duck, *Bird eggs, Hatching, Mortality, Oil spills, Oil pollution, Waterfowl, Chemical properties, Animal physiology, Growth stages, Embryonic growth stage, *Crude oil, *Dispersants, *Corexit 9527.

The paper reports the results of a study of the effects of Corexit 9527 dispersant, crude oil, and crude oil/Corexit 9527 mixtures on mallard duck (Anas platyrhynchos) embryos. Groups of eggs were treated with either 1, 5, or 20 ul of Prudhoe Bay (Alaska) crude oil, Corexit 9527, a 30:1 oil/Corexit mixture, or 5:1 oil/Corexit mixture. Mallard eggs treated with 20 ul of crude oil, Corexit 9527, 30:1 oil/Corexit 9527, 5:1 oil/Corexit 9527, and 5 ul Corexit 9527 and 5:1 oil/Corexit 9527 had significantly lower hatching success than the untreated control eggs. The comparisons between treated groups and the control and among treated groups were used to create a general toxicity ranking; (Corexit 9527 = 5:1 oil/Corexit 9527) > Prudhoe Bay crude oil > 30:1 oil/Corexit 9527. Corexit 9527 appeared to penetrate egg shells and shell membranes as readily as crude oil. No gross external malformations or behavioral abnormalities were observed. (Deal-EIS)
W80-01107

SOME EFFECTS OF CERTAIN METALS ON DEVELOPMENT AND MORTALITY WITHIN THE MOULT CYCLE OF CRANGON CRANGON(L.),
Hull, Univ. (England). Dept. of Zoology.
R. K. J. Price, and R. F. Uglow.
Marine Environmental Research, Vol 2, p 287-299, 1979. 4 Fig, 4 Tab, 32 Ref.

Descriptors: *Shrimp, *Mortality, *Heavy metals, *Growth stages, *Cadmium, *Copper, *Zinc, Size, Animal behavior, Animal physiology, Toxicity, *Crangon, Moulting.

Crangon crangon were subjected to three metals (Cd, Cu and Zn) at respective concentrations (0.35, 1.6 and 14.4 mg/litre) that would induce 50% mortality in 5-6 days. Significantly different rates of mortality occurred in the three groups, although their ET50's were almost identical. No moult-stage-dependent mortality was observed for Cd, but in Cu and Zn in the post-moult-stages were more susceptible than either the intermoult or premoult stage. No significant sex- or size-dependent mortality was evident at the tested concentrations of these metals. Feeding and ecdysis were inhibited in all metals after day 3 and development from one moult-stage to the next was greatly reduced in Cd. Possible modes of toxicity have been discussed in terms of the physiological condition inferred from the moult-stage at the time of death. (Deal-EIS)
W80-01108

MULTIPLE REGRESSION MODELING APPROACH FOR REGIONAL WATER QUALITY MANAGEMENT,
Geological Survey, Portland, OR.
D. J. Lystrom, F. A. Rinella, D. A. Rickert, and L. Zimmerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 319, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/7-78-198, October 1978, 59 p. 9 Fig, 4 Tab, 78 Ref, 4 Append. EPA-IAG-D5-0982.

Descriptors: *Statistical models, *Water quality, *Regional analysis, *Watersheds(Basins), *Susquehanna River, Model studies, Statistics, Mathematical models, Regression analysis, Equations, Numerical analysis, Water pollution sources, Regions, Pennsylvania, New York, Basins, Land use, Watershed management, Planning, Sediment transport, Nonpoint pollution, Soil properties.

Multiple-regression analysis was specifically structured to define basin characteristics controlling nonpoint pollution sources by assessing regional water quality variations in the Susquehana River basin in Pennsylvania and New York. The developed multiple-regression models are applicable only to the Susquehanna River and to hydrologically similar basins; however, the general approach is potentially applicable to other regions. Water quality is defined by four major properties: suspended sediment, dissolved solids, nitrogen, and phosphorus. These properties were selected because of their response to development in rural areas. These properties are expanded into 17 characteristics and are experimentally related to 57 other basin characteristics. Six general basin characteristics groups are: climate, geology, topography, soils, streamflow, and land use. Multiple-linear-regression equations relate water quality (dependent variables) to basin characteristics (independent variables). Multiple-regression models explain 56% to 89% of water quality characteristics variations, standard errors range from 17% to 75%. These models can estimate water quality at specific stream sites or simulate generalized land use effects on water quality. For example, observed nitrate yields are 20 times greater than simulated background yields; the increase indicates chemical fertilizer, animal waste, and urbanization impacts. (Danovich-Wisconsin)
W80-01118

EVIDENCE OF ARGO MERCHANT CARGO OIL IN MARINE BIOTA BY GLASS CAPILLARY GC ANALYSIS,
NOAA National Analytical Facility, Seattle, WA.
W. D. MacLeod Jr, L. C. Thomas, M. Y. Uyeda, and R. G. Jenkins.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 138-151, 8 Fig, 16 Ref.

Descriptors: *Oil spills, *Analytical techniques, *Pollutant identification, *Water pollution, *Fish, Sediments, Gas chromatography, Massachusetts, Weathering, *Outer continental shelf, Hydrocarbons, Pattern matching.

Thirty-seven samples of marine biota collected in response to the Argo Merchant oil spill were analyzed for hydrocarbons by glass capillary gas chromatography (GC). Rapid, temperature programmed analysis of hydrocarbons from n-C10H22 to n-C34H70 was demonstrated on a 2-m glass capillary. Analysis time was 7 minutes vs. 40 minutes or more on a 2-m packed column of comparable resolution. Finely detailed high resolution gas chromatograms were obtained on 20-m glass capillaries. The GC patterns of the saturated hydrocarbons extracted from marine biota were visually compared with the corresponding GC pattern from the Argo Merchant cargo. The stomach contents from two cod samples and one windowpane flounder sample afforded finely detailed gas chromatograms of saturated hydrocarbons that compared well with the cargo chromatogram. Analogous comparisons of the aromatic hydrocarbons confirmed the correlation for only one of the samples from cod. (Sinha - OEIS)
W80-01144

FATE AND EFFECT OF BUNKER C OIL SPILLED BY THE USNS POTOMAC IN MELVILLE BAY - GREENLAND - 1977,
Greenland Fisheries Investigations, Charlottenlund (Denmark).
For primary bibliographic entry see Field 5C.
W80-01148

THE EKOFISK BRAVO BLOWOUT. PETROLEUM HYDROCARBONS IN THE SEA,
Institute of Marine Research, Bergen (Norway).
For primary bibliographic entry see Field 5C.
W80-01154

PRESENCE AND SOURCES OF OIL IN THE SEDIMENT AND BENTHIC COMMUNITY SURROUNDING THE EKOFISK FIELD AFTER THE BLOWOUT AT BRAVO,
Nalco Environmental Sciences, Northbrook, IL.; and Masspec Analytical Speciality Services Ltd., Stroud (England).
For primary bibliographic entry see Field 5C.
W80-01155

INTERLABORATORY QUALITY CONTROL STUDY NO 19 TOTAL MERCURY IN WATER, LOW-LEVEL CONCENTRATIONS,
Canada Centre for Inland Water, Burlington (Ontario).
K. I. Aspila, and J. M. Carron.
Report Series No 62, 1979. 23 p, 5 Fig, 4 Tab, 8 Ref, 2 Append.

Descriptors: *Mercury, *Water quality, *Water quality control, *Water analysis, Laboratory tests, Sampling, Concentrations.

Results of an interlaboratory comparison of ten test samples containing mercury between 0.00 and 0.56 micro g per L are described. Twenty-seven Canadian laboratories participated. Test samples (100 mL) were preserved with 1 percent (v per v) H2SO4 plus 0.05 percent (w per v) K2Cr207 and distributed in Pyrex glass bottles with Teflon inserts. Because of breakages some participants received additional solutions contained in linear polyethylene bottles. Data were evaluated by the rejection of results greater than two standard devi-

ations from the mean. Using this adjusted data set, precision functions were developed to describe the interlaboratory standard deviations as a function of concentration. Within-run and between-run precision functions for in-laboratory analyses are also described. A number of laboratories have demonstrated that they have significant potential with respect to monitoring mercury in natural samples in the critical environmental range from 0.02 micro g per L to 0.20 micro g per L Hg. (WATDOC)
W80-01171

ENVIRONMENTAL IMPROVEMENT AT NEROUTSOS INLET, B. C. VOLUME 1 SUMMARY REPORT,
Rayonier Canada (B.C.) Ltd., Port Alice.
R. Tollefson, and E. Tokar.
Rayonier Canada (B.C.) Limited, December, 1978, 55 p, 17 Fig, 2 Tab, 10 Ref.

Descriptors: *Pulp & paper industry, *Pulp wastes, Water quality, Primary productivity, Benthos, *Salmon, Toxicity bioassay, Fish behavior, Fish populations, Fish repelling, Estuaries, *Vancouver Island, Neroutsos Inlet, Water pollution effects, Path of pollutants, Waste water disposal, Primary productivity.

A sulfite pulp mill has been in operation since 1917 at Port Alice, B.C. Until recently, its effluents have been discharged essentially untreated into the adjacent waters of Neroutsos Inlet. In 1978 Rayonier instituted an extensive environmental impact study of the Neroutsos Inlet area, involving both Provincial and Federal governmental agencies, academic and private consultant groups, as well as the company's personnel. This series of reports presents the 1978 results of these investigations covering water quality, primary productivity, benthic organisms, salmonid migrants, and toxicity studies of the effluent, in an effort to assess the overall quality of the environment, the benefits of the abatement program to date, and possible further abatement needs. The results to date show a pronounced improvement in the physical and chemical aspects of water quality. Limited local effects are still seen, however, in the immediate mill area. Salmonid populations appear to be within normal ranges for unpolluted waters and there is evidence of increases in certain other biological forms. However, in view of the observed variations in the populations, further study is recommended to better define and evaluate the controlling factors behind these variations. No environmental condition observed in 1978 is critical. (Detz-EIS)
W80-01192

ENVIRONMENTAL IMPROVEMENT AT NEROUTSOS INLET, B.C. VOLUME 5 MIGRATORY STUDIES OF JUVENILE SALMONIDS IN UPPER NEROUTSOS INLET, 1978,
Beak Consultants Ltd., Vancouver (British Columbia).
V. A. Poulin, and G. E. Roseberg.
Rayonier Canada, Port Alice, British Columbia, Dec., 1978, 56 p, 16 Fig, 5 Tab, 22 Ref, 19 Append.

Descriptors: *Salmon, *Fish migration, Estuaries, *Pulp & paper industry, *Pulping wastes, Monitoring, Water quality, Hydrogen ion concentration, Ammonium compounds, Neroutsos Inlet, Vancouver Island, Water pollution effects, Fish behavior, Fish food organisms, Industrial wastes, On-site-investigation, Port Alice, Seaward migration, Growth.

Fisheries studies were conducted from 17 March to 22 June, 1978, to describe the timing, relative abundance and migratory pathways of juvenile chum salmon (Oncorhynchus keta) in the upper headwaters of Neroutsos Inlet, Vancouver Island. Treated wastes from a pulp mill were discharged into the inlet at Port Alice. Catch results obtained by beach seine, surface trawl and fyke net indicated the downstream migration to inlet waters began in late February and seaward migration concluded in early June. After entering Neroutsos Inlet juvenile chum salmon dispersed in offshore inlet waters and along the eastern and western shorelines of the narrow waterbody. In the vicinity of Port Alice east side migrants were absent from nearshore areas and did not reappear until some 2.0 to 2.5 km down-inlet. Juvenile chum captures revealed that seaward migration peaked in mid to late April. In early May migrant numbers showed a decline and by the end of the month most juveniles had passed seaward of the Frigon Islets. (Katz-EIS)
W80-01195

EMBRYO-LARVAL TOXICITY TESTS WITH ORGANIC COMPOUNDS,
Thomas Hunt Morgan School of Biological Sciences, Lexington, KY.
W. J. Birge, J. A. Black, J. E. Hudson, and D. M. Bruser.
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 131-147, 1979. 4 Fig, 5 Tab, 21 Ref. OWRT A-074-KY(1).

Descriptors: *Bioassay, *Organic compounds, *Toxicity, Methodology, Laboratory tests, Analytical techniques, Bass, Channel catfish, Rainbow trout, Phenols, Fish eggs, Embryonic growth stage, Larval growth stage, Fish physiology, *Aniline, *Chlorobenzene, *Teratogens.

A continuous-flow system was developed for evaluating the effects of insoluble and volatile organics on the developmental stages of fish. A closed test system, devoid of standing air space, was used to minimize volatility as a variable. Insoluble compounds were suspended in influent water by mechanical homogenization, without the use of carrier solvents. Tests were performed with aniline, chlorobenzene, and phenol. Water hardness was maintained at 50 and 200 mg/litre calcium carbonate, and exposure was continuous from fertilization through four to eight days after hatching for largemouth bass, channel catfish, goldfish, and rainbow trout. The results indicated that there was good reproducibility of exposure concentrations down to 1 microg/litre or less. When phenol was administered in hard water, the LC1 and LC50 values determined at hatching were 0.2 and 80 microg/litre for trout, and 2.0 and 710 microg/litre for goldfish. Phenol was less toxic in soft water. Chlorobenzene at 0.09 mg/litre produced complete mortality of trout eggs. When bass eggs were exposed through four days after hatching, the LC50s for chlorobenzene ranged from 50 to 60 microg/litre. The aniline LC50 values calculated for catfish, goldfish, and bass eggs treated in soft water were 5.6, 10.2 and 47.3 mg/litre, respectively. Because of the differential rates of larval mortality for the three species, the LC50 range narrowed considerably when the exposure time was increased beyond hatching. Water hardness exerted no appreciable effects on the toxicity of either chlorobenzene or aniline. All three organic compounds produced significant frequencies of teratic larvae. (Deal-EIS)
W80-01197

HIERARCHICAL DIVERSITY OF COMMUNITIES OF AQUATIC INSECTS AND FISHES,
Kansas Univ., Lawrence. Dept. of Geology.
R. L. Kaesler, and E. E. Herricks.
Water Resources Bulletin, Vol 15, No 4, p 1117-1125, 1979. 1 Fig, 9 Tab, 7 Ref. OWRT C-6007 (°5200)(6).

Descriptors: *Biological communities, *Sampling, *Bioindicators, *Analytical techniques, Mathematical studies, Fish populations, Monitoring, Aquatic insects, Data collections, Ecology, Statistical analysis, Mathematical models, *Diversity, *Species diversity.

Hierarchical diversity analysis of data on fish and aquatic insects showed that the component of diversity contributed by the species level was generally very small compared with the component at the generic level or with the total diversity. Very high rank correlations between generic diversity, in which genera were discriminated but not identified, and species diversity suggested that the purposes of environmental monitoring might best be served by working at the generic level rather than the species level. This is particularly true when an index of diversity is to be used as the major comparative and communicative tool. The savings of time and money could be appreciable. (Deal-EIS)
W80-01198

5B. Sources Of Pollution

A RECURRENCE MODEL FOR THE PREDICTION OF DDT FLUX IN ATLANTIC MENHADEN,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
S. M. Warlen.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 425-431, 1977. 3 Fig, 2 Tab, 9 Ref.

Descriptors: *Atlantic menhaden, *DDT, *Mathematical models, Chlorinated hydrocarbon pesticides, Path of pollutants, Animal metabolism, Fish physiology, Fish migrations, Pesticide residues, Ecosystems, Model studies, *Bioaccumulation.

A simple recurrence model is developed for the prediction of DDT flux through Atlantic menhaden (Brevoortia tyrannus). The DDT body burden in young-of-the-year menhaden at any time is equal to the body burden on the previous day plus the DDT accumulated on the current day minus the DDT turnover. Accumulation of DDT is simulated and compared with field observations. Estimations of DDT ingestion, assimilation, turnover, and egestion are made on both per fish and population bases. It is estimated that emigrating juvenile menhaden export 20 g DDT/year from the Newport River estuary in North Carolina. (Deal-EIS)
W80-00806

HEAVY METAL EXCHANGE BY ASCOPHYLLUM NODOSUM (PHAEOPHYCEAE) PLANTS IN SITU,
Trondheim Univ. (Norway). Inst. of Marine Biochemistry.
S. Myklestad, I. Eide, and S. Melsom.
In: Proceedings of the Ninth International Seaweed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 143-151, 1977. 4 Tab, 6 Ref.

Descriptors: *Phaeophyta, *Heavy metals, *Plant physiology, Metabolism, Ion exchange, Plant growth, Growth stages, Absorption, *Zinc, *Cadmium, *Lead, Plant morphology, *Mercury, Chemical analysis, *Tissue analysis.

The uptake and loss of heavy metal in Ascophyllum nodosum have been studied in the field by exchanging plants between uncontaminated and metal contaminated sites. The tissue synthesized at the new site had a metal composition similar to the newly synthesized tissue in the native plants from the same locality. The different metals showed somewhat different patterns regarding the metal exchange process. Some possible mechanisms are discussed in relation to current theories of heavy metal exchange in brown algae. (Deal-EIS)
W80-00816

UPTAKE, BIOTRANSFORMATION, DISPOSITION, AND ELIMINATION OF 2-METHYLNAPHTHALENE AND NAPHTHALENE IN SEVERAL FISH SPECIES,
Medical Coll. of Wisconsin, Milwaukee. Dept. of Pharmacology.
For primary bibliographic entry see Field 5A.
W80-00821

AN ASSESSMENT OF DDT TOXICITY ON OSMOREGULATION AND GILL NA,K-ATPASE ACTIVITY IN THE BLUE CRAB,
Emporia State Univ., KS. Div. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-00822

ACEPHATE AND FENITROTHION TOXICITY IN RAINBOW TROUT: EFFECTS OF TEMPERATURE STRESS AND INVESTIGATIONS ON THE SITE OF ACTION,

National Inland Fisheries Inst., Bangkok (Thailand).
For primary bibliographic entry see Field 5A.
W80-00823

EXCRETION OF THE LAMPRICIDE BAYER 73 BY RAINBOW TROUT,
Fish and Wildlife Service, La Crosse, WI. Fish Control Lab.
J. L. Allen, V. K. Dawson, and J. B. Hunn
In: Aquatic Toxicology, ASTM STP 667, L. L. Marking and R. A. Kimerle, Eds, American Society for Testing and Materials, p 52-61, 1979. 4 Fig, 1 Tab, 13 Ref.

Descriptors: *Rainbow trout, *Animal metabolism, *Pesticide kinetics, Path of pollutants, Fish physiology, Chemical analysis, Ions, Sodium, Potassium, Calcium, Magnesium, Chlorides, Chemical properties, *Bayer 73, *Lampricides, *Tissue analysis.

Urinary excretion of the 2-aminoethanol salt of 2', 5-dichloro-4'-nitro-salicylanilide (Bayer 73) in rainbow trout was measured after exposure of the trout to Bayer 73 and also after intraperitoneal (ip) injection of the lampricide. Fish exposed to 0.05 mg/litre of Bayer 73 for 12 h quickly began to excrete residues in the urine. The largest amount of Bayer 73 was excreted during the 12-h exposure, but the trout continued to excrete Bayer 73 beyond 60 h after exposure. They excreted up to 25% of the dose in the urine, and 20% was recovered glucuronide conjugate. The exposure of rainbow trout to Bayer 73 at the doses studied had no effect on the urine output or on the renal excretion of sodium (Na+), potassium (K+), calcium (Ca2+), magnesium (Mg2+), and chloride (C1-). (Deal-EIS)
W80-00824

TAINT THRESHOLD OF DIPHENYL OXIDE IN RAINBOW TROUT,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
For primary bibliographic entry see Field 5A.
W80-00828

UPTAKE, DEPURATION, AND TOXICITY OF HEXAMETHYLPHOSPHORAMIDE IN AQUATIC ORGANISMS,
Haskell Lab. for Toxicology and Industrial Medicine, Newark, DE.
For primary bibliographic entry see Field 5A.
W80-00833

CONCENTRATION OF ELEMENTS IN MARINE ORGANISMS CULTURED IN SEAWATER FLOWING THROUGH COAL-FLY ASH,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 5A.
W80-00834

EVIDENCE FOR THE PROTECTIVE EFFECT OF METALLOTHIONEINS AGAINST INORGANIC MERCURY INJURIES TO FISH,
Liege Univ. (Belgium). Lab. d'Oceanogolie.
For primary bibliographic entry see Field 5A
W80-00839

ENVIRONMENTAL BROMINE IN FRESHWATER AND FRESHWATER ORGANISMS: FACTORS AFFECTING BIOACCUMULATION,
Middle Tennessee State Univ., Murfreesboro. Dept. of Chemistry and Physics.
For primary bibliographic entry see Field 5A.
W80-00840

IDENTIFICATION OF THE HERBICIDE 2,4,6-TRICHLOROPHENYL P4-NITROPHENYL ETHER IN IMPORTED RAINBOW TROUT,
Food and Drug Administration, Brooklyn, NY.
For primary bibliographic entry see Field 5A.
W80-00841

ACUTE ENDRIN TOXICITY ON OXIDASES OF OPHIOCEPHALUS PUNCTATUS (BLOCH),
Hindu Coll., Moradabad (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00842

STUDIES ON THE DEPURATION OF CADMIUM AND COPPER BY THE AMERICAN OYSTER CRASSOSTREA VIRGINICA,
Environmental Research Lab., Narragansett, RI.
G. E. Zaroogian.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 117-122, 1979. 1 Fig, 1 Tab, 14 Ref.

Descriptors: *Cadmium, *Copper, *Oysters, Path of pollutants, Heavy metals, Animal physiology, Animal metabolism, Water chemistry, Chemical analysis, Water temperature, Growth rates, *Tissue analysis, *Bioaccumulation, *Depuration.

This study was an attempt to establish under laboratory conditions whether treated oysters would depurate accumulated cadmium and copper when returned to cleaner waters containing natural concentrations of these metals. The oysters were treated with cadmium for 40 weeks. Depuration of cadmium proceeded for 16 weeks following treatment. Since the oysters contained high concentrations of copper at the time of collection, depuration of copper was studied for 56 weeks. Data indicated that cadmium was not depurated by C. virginica under the conditions of this experiment, particularly a declining temperature regime. No significant decrease in copper concentration occurred in either the control or cadmium treated oysters with increasing or decreasing temperature regimes. (Deal-EIS)
W80-00843

DISTRIBUTION OF RADIOACTIVITY IN COALFISH (POLLACHIUS VIRENS) FOLLOWING INTRAGASTRIC ADMINISTRATION OF (9-14C) PHENANTHRENE,
Bergen Univ. (Norway). Inst. of Fisheries Biology.
For primary bibliographic entry see Field 5A.
W80-00844

POLLUTANT LEVELS IN THE GREAT SKUA CATHARACTA SKUA,
Durham Univ. (England). Dept. of Zoology.
R. Furness, and M. Hutton.
Environmental Pollution, Vol 19, p 261-268, 1979. 7 Tab, 22 Ref.

Descriptors: *Bioindicators, *Chlorinated hydrocarbon pesticides, *Water birds, DDT, Polychlorinated biphenyls, DDE, Dieldrin, Heavy metals, Bird eggs, Food habits, Animal physiology, Animal metabolism, Path of pollutants, *Selenium, *Bioaccumulation, *Tissue analysis, *HCB, *Skua.

The great skua combines the traits favouring accumulation of pollutants. Levels of PCB and DDE are high, but there is no evidence of egg-shell thinning. There are indications of age-accumulation of heavy metals in adult great skuas and renal cadmium levels are very high in some individuals. Selenium concentrations correlate with mercury and cadmium concentrations. Possible protective effects of selenium are discussed. Levels of PCBs, DDE, HCB and dieldrin in eggs all correlate with each other, and vary greatly between individuals, suggesting individual variation in excretory rates, feeding habits or distribution in winter. Mercury levels in primary feathers correlate with those in liver so may be used to monitor without killing birds. The feeding habits and migrations of the great skua make it a suitable indicator of offshore pollution in the north-east Atlantic. (Deal-EIS)
W80-00845

VARIABILITY OF THE CONCENTRATIONS OF SEVENTEEN TRACE ELEMENTS IN THE MUSCLE AND LIVER OF A SINGLE STRIPED BASS, MORONE SAXATILIS,
Department of Energy, New York. Environmental Measurement Lab.
For primary bibliographic entry see Field 5A.
W80-00846

DETERMINATION METHOD FOR RESIDUAL 1,3-DICHLORO-AND 1,3,5-TRICHLORO-2-(4-NITROPHENOXY) BENZENE (NIP AND CNP) IN FISH AND SHELLFISH,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
For primary bibliographic entry see Field 5A.
W80-00847

ORGANOCHLORINE RESIDUES IN EGGS OF THE ENDANGERED AMERICAN CROCODILE (CROCODYLUS ACUTUS),
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W80-00848

ABERRATIONS IN THE NEUROSECRETORY CELLS OF A FRESHWATER PULMONATE, INDOPLANORBIS EXUSTUS, CHRONICALLY EXPOSED TO SUBLETHAL CONCENTRATION OF TWO MOLLUSCICIDES, BACL2 AND CUSO4,
Marathwada Univ., Aurangabad (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00849

FATE OF 14C-CIS-CHLORDANE IN GOLDFISH, CARASSIUS AURATUS (L.),
Illinois Univ. at the Medical Center, Chicago. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A
W80-00850

EFFECTS OF IN VIVO CADMIUM EXPOSURE ON ATPASSES IN GILL OF THE LOBSTER, HOMARUS AMERICANUS,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
For primary bibliographic entry see Field 5A.
W80-00851

HEXACHLOROBENZENE (HCB) LEVELS IN LAKE ONTARIO SALMONIDS,
Canada Centre for Inland Waters Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W80-00852

ALKANES IN BARNACLES (BALANUS TINTINNABULUM) FROM THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
For primary bibliographic entry see Field 5A.
W80-00853

PARATHION CAUSES SECONDARY POISONING IN A LAUGHING GULL BREEDING COLONY,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
For primary bibliographic entry see Field 5A.
W80-00854

IN VITRO TOXICITY OF EIGHT MUTAGENS/CARCINOGENS FOR THREE FISH CELL LINES,
Washington Univ., Seattle. Dept. of Pathology.
For primary bibliographic entry see Field 5A
W80-00855

OCCURRENCE OF PCB RESIDUES IN BURBOT (LOTA LOTA) AND LAKE TROUT (SALVELINUS NAMAYCUSH) FROM THE CHURCHILL FALLS POWER DEVELOPMENT AREA,
Department of Fisheries and Environment, Halifax (Nova Scotia).
For primary bibliographic entry see Field 5A.
W80-00856

COMBINED EFFECTS OF TEMPERATURE, SALINITY AND CADMIUM ON DEVELOP-

MENT, GROWTH AND MORTALITY OF MYTILUS EDULIS LARVAE FROM THE WESTERN BALTIC SEA,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
W. Lehnberg, and H. Theede.
Helgolander wissenschaftlichen Meeresuntersuchungen, Vol 32, p 179-199, 1979. 9 Fig, 3 Tab, 28 Ref.

Descriptors: *Cadmium, *Salinity, *Water temperature, *Toxicity, *Animal growth, Growth rates, Growth stages, Larval growth stage, Mortality, Animal physiology, Animal metabolism, Animal populations, Mussels, *Mytilus.

The response surface method was used to study the effects of temperature, salinity and Cd contamination on the development of fertilized eggs of Mytilus edulis to the veliger stage as well as on growth and cumulative mortality of a veliger population. The reactions observed differ considerably with reference to temperature and salinity. Cd only slightly influences various temperature-dependent life functions, but strongly modifies those depending on salinity. The development optimum is shifted to higher salinities with increasing Cd concentrations of the medium, while that of survival and growth is shifted to lower salinities. These factor interactions modify the tolerance limits. In addition, the rates of factor interactions on the larval stages change with the degree of development. The trochophora stage proves to be most sensitive to the factors studied. A significant influence of cadmium on different life functions is found from concentrations of about 50 ppb on. (Deal-EIS)
W80-00858

TOXICITY AND TISSUE UPTAKE OF METHYLMERCURY ADMINISTERED INTRAPERITONEALLY TO RAINBOW TROUT (SALMO GAIRDNERI RICHARDSON),
Alberta Univ., Edmonton. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00859

POLYCHLORINATED BIPHENYLS IN PLANKTON FROM THE TURKU ARCHIPELAGO,
Turku, Univ. (Finland). Dept. of Chemistry and Biochemistry.
For primary bibliographic entry see Field 5A.
W80-00861

INFLUENCE OF SALINITY AND CADMIUM ON CAPSULE STRENGTH IN PACIFIC HERRING EGGS,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 5A.
W80-00865

DDT AND ITS METABOLITES IN ANTARCTIC BIRDS,
Warsaw Univ. (Poland). Dept. of Zoology and Ecology.
For primary bibliographic entry see Field 5A.
W80-00867

DDT AND ITS METABOLITES IN ANTARCTIC KRILL (EUPHAUSIA SUPERBA DANA) FROM SOUTH ATLANTIC,
Warsaw Univ. (Poland). Dept. of Zoology and Ecology.
For primary bibliographic entry see Field 5A.
W80-00868

RESULTS OF TESTING LANDSPREADING OF TREATED MUNICIPAL WASTEWATER AT ST. PETERSBURG, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. C. Reichenbaugh, D. P. Brown, and C. L. Goetz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 730, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-110, 1979. 47 p, 10 Fig, 14 Tab, 8 Ref.

Descriptors: *Water spreading, *Irrigation effects, *Waste water disposal, *Sewage, *Water pollution effects, Bermudagrass, Soil water movement, Path of pollutants, Soil-water-plant relationships, Tile drains, Water reuse, Infiltration, Water table, Groundwater recharge, Nutrients, Bacteria, Coliforms, Florida, *St. Petersburg, Secondary-treated effluent.

Chlorinated secondary-treated effluent was used to irrigate a grassed 4-acre site at rates of 2 and 4 inches per week for periods of 11 and 14 weeks, respectively. Part of the site was drained by tile lines 5 feet below land surface. Irrigation of the drained plot resulted in rapid passage of the applied wastewater through the soil and, consequently, poor nitrogen removal. The rapid percolation permitted nitrification but prevented denitrification. Total phosphorus in the shallow ground water at the site increased from a maximum of 1.4 milligrams per liter before irrigation to as much as 5 milligrams per liter in the ground water 5 feet below land surface. Concentrations of nitrogen and phosphorus did not increase in ground water downgradient from the site, although increased chloride concentrations demonstrated downgradient migration of the applied wastewater. Prior to irrigation, total coliform bacteria were not detected in ground water at the site. After irrigation, total and fecal coliforms were detected in the ground water at the site and downgradient. (Woodard-USGS)
W80-00924

QUANTITY AND QUALITY OF URBAN RUNOFF FROM THREE LOCALITIES IN THE DENVER METROPOLITAN AREA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4C.
W80-00927

EFFECT ON SEDIMENT YIELD AND WATER QUALITY OF A NONREHABILITATED SURFACE MINE IN NORTH-CENTRAL WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div., and Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2J.
W80-00928

BASELINE WATER QUALITY OF IOWA'S COAL REGION,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-00931

PESTICIDE RESIDUES IN AGRICULTURAL DRAINS, SOUTHEASTERN DESERT AREA, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
L. A. Eccles.
Available from the National Technical Information Service, Springfield, VA 22161 PB-300 824/AS, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-16, March 1979. 60 p, 13 Fig, 7 Tab, 4 Ref.

Descriptors: *Pesticides, *Agricultural runoff, *Tile drains, *Irrigation water, *California, Deserts, Data collections, Sampling, Chemical analysis, *Pesticide residues, Bed material, Irrigation tailwater, Aerial drift.

A study is being made to determine the occurrence and distribution of pesticides in the agricultural drains for approximately 3/4 million irrigated acres in the southeastern desert area of California. This report describes the results of the first year of sampling and analyzing (1) water in the drains, (2) bed material in the drains, (3) water from field tile-drainage lines, and (4) irrigation tailwater and water in the drains directly exposed to drift from aerial application of pesticides. Residues of almost all the pesticides selected for monitoring were found in water in the drains. Examination of the data to determine the probable source of pesticides indicated generally slight concentrations from bed material in the drains, usually no detectable concentrations from field tile-drainage lines, and apparently large concentrations from irrigation tailwater and drift from aerial application. (Woodard-USGS)
W80-00942

HYDROLOGIC DATA FOR THE SOUTHWEST SUBSURFACE-INJECTION TEST SITE, ST. PETERSBURG, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. J. Hickey, and R. M. Spechler.
Geological Survey open-file report 78-852, 1979. 104 p, 9 Fig, 29 Tab, 13 Ref.

Descriptors: *Injection wells, *Groundwater movement, *Baseline studies, *Waste disposal wells, *Water quality, Tracers, Dye releases, Rhodamine, Forecasting, Path of pollutants, Aquifers, Water levels, Water analysis, Florida, *Floridan aquifer, *St. Petersburg(Fla).

Three injection wells and nine observation wells were constructed at the Southwest St. Petersburg, Fla., site to determine feasibility of injecting wastewater treatment plant effluent into permeable zones containing saline water. Two withdrawal tests and one injection test were performed. Both withdrawal tests ran for about 3 days; one discharging 650 gallons per minute, and the other discharging 6,490 gallons per minute. The injection test was run in one well for 91.1 days at an average rate of 2,830 gallons per minute. Injection well pressure reached a maximum of 48.1 pounds per square inch near the end of the test. Rhodamine WT was used as a tracer during the injection test and was identified in three wells. Before the injection test, chloride concentration in a well 35 feet from the injection well, and in a well 733 feet distant, ranged from 19,000 to 21,000 milligrams per liter. At the end of the test, chloride concentration in one well was 1,800 milligrams per liter and 5,400 milligrams per liter in another. Eleven wells near the site were sampled before the test for water-quality analyses and chlorides ranged from 18 to 1,400 milligrams per liter. (Woodard-USGS)
W80-00943

ONE-DIMENSIONAL STEADY-STATE STREAM WATER-QUALITY MODEL,
Geological Survey, Lakewood, CO. Water Resources Div., and Geological Survey, NSTL Station, MS. Water Resources Div.
D. P. Bauer, M. E. Jennings, and J. E. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 327, Price codes: A09 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-45, March 1979. 215 p, 3 Fig, 17 Ref.

Descriptors: *Model studies, *Water quality, *Streams, *Waste water disposal, *Water pollution, Mathematical models, Nutrients, Biochemical oxygen demand, Dissolved oxygen, Nitrification, Phosphorus compounds, Coliforms, Bacteria, Streamflow, Runoff, Computer models.

A computer program, based on a one-dimensional mathematical model which predicts the stream water-quality response characteristics from waste source inputs, is described and documented. Variables predicted include dissolved oxygen, biochemical oxygen demand, nitrogen forms, total and fecal-coliform bacteria, orthophosphate-phosphorus, and various conservative substances. The model is based primarily on the Streeter-Phelps oxygen-sag equation. Special options of the program include the capability of handling nonpont source waste inputs and anoxic conditions. The model formulation is based on a steady-state assumption which requires constant flow rate of waste and stream discharges and associated parameters. To achieve a problem solution, each reach of a stream system is broken into a given number of subreaches, generally defined by locations of waste

or tributary inflow points. All waste constituents are assumed to be completely mixed within any cross section. (Woodard-USGS)
W80-00945

THE LIMNOLOGICAL RESPONSE OF A WEST VIRGINIA MULTIPURPOSE IMPOUNDMENT TO ACID INFLOWS,
Army Engineer District, Pittsburgh, PA.
M. Koryak, L. J. Stafford, and W. H. Montgomery.
Water Resources Research, Vol 15, No 4, p 929-934, August 1979. 6 Fig, 2 Tab, 5 Ref.

Descriptors: *Lakes, *Limnology, *Acid mine water, *West Virginia, Sampling, Data processing, Acids, Water pollution, Pollutants, Path of pollutants, Water temperature, Density, Dissolved oxygen, Iron, Streamflow, Rivers, Water chemistry, Hydrogen ion concentration, Biological properties, Phytoplankton, Benthic fauna, *Tygart River Lake(WV).

Periodic intrusions of acid mine drainage enter Tygart River Lake during the summer and autumn months. In spite of only moderate vertical thermal gradients in the reservoir, these inflows penetrate the impoundment as well-defined temperature-density currents. The depth of penetration and resulting mixing patterns of the acid inflows are influenced by the design and operation of the dam. The internal hydrodynamics of the reservoir, in turn, influence the chemistry and biology of both the impoundment and the outflow. (Sims-ISWS)
W80-00954

A NEW NUMERICAL METHOD FOR SOLVING THE SOLUTE TRANSPORT EQUATION,
Analytic Sciences Corp., Reading, MA.
For primary bibliographic entry see Field 2F.
W80-00956

SUSPENDED SEDIMENT SOURCES IDENTIFIED BY MAGNETIC MEASUREMENTS,
Exeter Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W80-00964

THE EFFECTS OF URBANIZATION ON GROUND-WATER QUALITY--A CASE STUDY,
Wisconsin Univ. -Madison. Dept. of Geology and Geophysics.
C. Eisen, and M. P. Anderson.
Ground Water, Vol 17, No 5, p 456-462, September-October 1979. 7 Fig, 3 Tab, 22 Ref. EPA R00514201.

Descriptors: *Groundwater, *Water pollution, *Urbanization, *Wisconsin, Pollutants, Path of pollutants, Water pollution sources, Chlorides, Sulfates, Ammonia, Bacteria, Coliforms, Streptococcus, Sampling, On-site investigations, Watersheds(Basins), Cities, Effects, Wells, Water wells, Hydrology, Geology.

The results from a 1 1/2-year study of groundwater quality in the vicinity of Milwaukee, Wisconsin, supported the suggestion by other researchers that chloride and sulfate are the principal products of urbanization which alter groundwater chemistry. In addition to chloride and sulfate, groundwater samples from the Menomonee River Watershed contained relatively high concentrations of ammonium, fecal coliform, and fecal streptococci bacteria. Field data suggested that contamination of groundwater is caused by infiltration of surface water polluted by municipal and industrial wastes and (or) leakage from sewer lines. Some additional chloride contamination by infiltration of road salt was also suggested. (Sims-ISWS)
W80-00965

TEMPORAL VARIATION IN THE NUTRIENT EXPORT OF RIVERS DRAINING INTO THE BAY OF QUINTE, ONTARIO, CANADA,
Canada Centre for Inland Waters, Burlington (Ontario).
C. K. Minns, and M. G. Johnson.
Water Resources Bulletin, Vol 15, No 4, p 1061-1072, August 1979. 5 Fig, 5 Tab, 6 Ref.

Descriptors: *Nutrients, *Rivers, *Lake Ontario, *Canada, Surveys, Sampling, Data processing, Nitrogen, Nitrates, Nitrites, Phosphorus, Varability, Temporal distribution, Drainage, Flow, Runoff, Regression analysis, Pollutants, Water pollution, *Bay of Quinte(Ontario).

Annual exports of total phosphorus, soluble reactive phosphorus, and total nitrogen were presented for the period 1965-1974 for 5 rivers draining into the Bay of Quinte, Lake Ontario. The export values were typical for the physiography and land use, though the results indicated that soluble reactive phosphorus exports for the 4 largest rivers have been declining. Also, the variation in export of total phosphorus and total nitrogen was highly correlated with variation in annual runoff. This was noted as being a factor deserving more attention in future efforts to classify nutrient export values in relation to land use and geology. (Sims-ISWS)
W80-00968

SOURCE ASSESSMENT: RECLAIMING OF WASTE SOLVENTS, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
For primary bibliographic entry see Field 5A.
W80-00988

PUBLIC ATTITUDES TOWARD COMMUNITY WASTEWATER RECLAMATION AND REUSE OPTIONS,
California Univ., Berkeley. School of Public Health.
W. H. Bruvold.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110851, Price codes: A04 in paper copy, A01 in microfiche Technical Completion Report, Contribution No.179, Water Resources Center, Univ. of Calif Davis, August 1979, 52 p., 29 Tab, 1 Append (Calif. Water Resources Center Project UCAL-WRC-W-515), OWRT-A-061-CAL(1).

Descriptors: *Water reuse, *Attitudes, *Public health, Waste treatment, Irrigation, Environmental effects, California, Public reaction.

One hundred forty people in each of ten California cities were interviewed about their personal attitudes toward reclaimed water. Attitudinal results showed that respondents generally were unfavorable disposed toward the use of reclaimed water for drinking. However, they did favor options that protected public health, enhanced the environment and conserved scarce water resources. High degrees of treatment and then reuse for some beneficial purpose such as agricultural and parkland irrigation was most favored, while minimal waste treatment and subsequent discharge into the environment without reuse was not favored. Cost did not appear to be an important factor in their decisions about reclaimed water. (Snyder-Calif)
W80-01002

ANALYSIS OF MONITORING DATA FOR SUSPENDED SOLIDS, SOLUBLE PHOSPHORUS AND ADSORBED PHOSPHORUS AT THE MENOMONEE RIVER,
Wisconsin Univ. -Madison. Dept. of Statistics.
R. B. Miller, W. Bell, and R. Y-Y Wang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110844, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin, Partial Technical Report, 1979. 41 p, 15 Fig, 8 Tab, 1 Append. OWRT B-103-WIS (1). 14-34-0001-8129.

Descriptors: *Sampling, *Statistical methods, *Water quality control, *Regions, *Great Lakes, *Statistical models, Suspended solids, Phosphorus, *Menomonee river(Wis).

Measurements of concentrations of suspended solids, soluble phosphorus and adsorbed phosphorus are categorized as having been collected during high or low flow events. Within each category, variation in the concentrations is analyzed for the effects of variation in season of the year, time of day, and day of week. A small but persistent day-of-the-week effect is present, suggesting somewhat periodic behavior over weeks. No significant time-of-day effect is discovered. A variety of figures and tables supplement the formal statistical calculations.
W80-01004

REMOVAL OF 'SOLUBLE' IRON IN THE POTOMAC RIVER ESTUARY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst
For primary bibliographic entry see Field 5A.
W80-01014

DISCUSSION OF THE BEHAVIOUR OF NON-CONSERVATIVE DISSOLVED CONSTITUENTS IN ESTUARIES,
Dartmouth Coll., Hanover, NH. Dept. of Earth Sciences.
C. B. Officer
Estuarine and Coastal Marine Science, Vol 9, No 1, p 91-94, July 1979. 3 Fig, 3 Ref.

Descriptors: *Dispersion, *Mixing, *Dissolved solids, *Aluminum, Model studies, Mathematical models, Pollutants, Path of pollutants, Metals, Salinity, Chemicals, Estuaries, Diffusion-advection models.

A simplified relation for the loss of a dissolved constituent in an estuary was derived. The relation is applicable to steady state, one dimensional, tidal averaged conditions. Caution should be exercised in its use, as well as in the measurement procedures and the interpretation of measurements of dissolved constituents, for such simplifications may not be appropriate, requiring more complex estuarine hydrodynamic effects to be considered. (Sims-ISWS)
W80-01017

URBAN RUNOFF POLLUTION METHOD,
GKY and Associates, Inc., Alexandria, VA.
G. K. Young, T. R. Bondelid, and D. N. Athayde.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 105, No WR2, Proceedings Paper 14854, p 353-369, September 1979. 5 Fig, 2 Tab, 19 Ref, 2 Append. EPA 68-01-3594

Descriptors: *Water pollution sources, *Urban runoff, *Water quality, *Model studies, Mathematical models, Water pollution, Pollutants, Path of pollutants, Planning, Cities, Runoff, Storm runoff, Sewers, Combined sewers, Separated sewers, Storage, Effects, Hydrology, Environmental engineering.

This work devised a simplified method to evaluate the event magnitude of nonpoint source rain-induced UBOD loads for urban areas. The method is flexible, non-dependent upon computer simulation, and uses readily available data. The results appear to be realistic. Ten urban watersheds were studied using a methodology that assumes triangular hydrographs and piece-wise linear pollutographs. A rapid method for estimating pollutant loadings in terms of pounds per acre per storm was presented. UBOD was used in this study, but the methodology is readily adaptable to other parameters. The effects of storage and street sweeping on total storm loadings were preliminarily evaluated. (Sims-ISWS)
W80-01027

DENITRIFICATION IN THE NITROGEN BUDGET OF A RIVER ECOSYSTEM,
York Univ., Toronto (Ontario). Dept. of Geography
A. R. Hill
Nature, Vol 281, No 5729, p 291-292, September 27, 1979. 2 Fig, 8 Ref.

Descriptors: *Water quality, *Denitrification, *Rivers, *Canada, Watersheds(Basins), Ecosys-

tems, Nitrogen, Aquatic environment, On-site investigations, Nitrates, Water samples, Analysis, Sediments, *Duffin Creek(Ontario), Nitrogen budget.

Recent studies indicate that bacterial denitrification in anaerobic sediments may play a major part in removing nitrogen from water during river transport. As this reaction reduces nitrate-N primarily to gaseous nitrogen, it represents a potentially significant pathway for the permanent removal of nitrogen from aquatic environments. However, no detailed assessments have been made of the quantitative importance of denitrification in relation to river nitrogen budgets. The author investigated this problem by studying the role of denitrification in relation to the nitrogen budget of Duffin Creek near Toronto, Ontario, and reported that the removal of nitrate-N by denitrification in the downstream reaches of the river represents 5-6% of the annual export of total nitrogen from this river basin. Duffin Creek has an average flow of 220,000 cu m/d and drains a predominantly rural watershed of 262 sq km. Nitrogen transport was measured at intervals along the two main branches of the river. (See also W77-12435) (Humphreys-ISWS)
W80-01041

NUMERICAL SIMULATION OF MATERIAL TRANSPORT IN A REGIONAL GROUNDWATER FLOW SYSTEM,
California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 2F.
W80-01042

EFFECTS ON HATCHING IN LITTORINA LITTOREA AFTER AN OIL SPILL,
Institute of Marine Research. Bergen (Norway).
J. F. Staveland.
Marine Pollution Bulletin, Vol 10, p 255-258, 1979.
4 Fig, 1 Tab, 10 Ref.

Descriptors: *Oil spills, *Toxicity, *Snails, Gastropods, Reproduction, Oil, Oil pollution, Organic compounds, Fertility, Larval growth stage, Fecundity, *Crude oil, *Teratogens.

One year after an accidental spill of approximately 2000 t of Iranian crude oil on the west coast of Norway, specimens of the gastropod Littorina littorea were collected from the oil polluted shore and allowed to spawn in the laboratory. Snails were also collected from an unpolluted reference site. The oil contamination seemed to have no detectable effects on fertilization. However, the hatching success of the veliger larvae was significally less in the 'oil polluted' population. Some highly abnormal eggs were also observed in this egg population. (Deal-EIS)
W80-01043

FINE PARTICULATE ORGANIC CARBON OUTPUT FROM FENS AND ITS EFFECT ON BENTHIC MACROINVERTEBRATES,
California Univ., Berkeley. Dept. of Forestry and Conservation.
For primary bibliographic entry see Field 5A.
W80-01045

ZINC CONCENTRATIONS IN JUVENILE FLATFISH,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
For primary bibliographic entry see Field 5A.
W80-01048

THE EFFECTS OF MACROPHYTES ON HYDROCHEMISTRY OF THE SHALLOWS OF THE KREMENCHUG RESERVOIR,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W80-01052

PHYSIOLOGICAL MECHANISMS OF THE ACTION OF TOXIC SUBSTANCES, AND ADAPTATION OF AQUATIC ANIMALS TO THEM,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 5A.
W80-01057

UPTAKE AND ACCUMULATION OF CADMIUM BY OPHRYOTROCHA DIADEMA (POLYCHAETA),
Biologische Anstalt Helgoland Hamburg. (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W80-01062

OBSERVATIONS OF MERCURY LEVELS IN BRANCHIOSTOMA CARIBAEUM,
Swedish Water and Air Pollution Research Lab., Stockholm.
For primary bibliographic entry see Field 5A.
W80-01067

ACCUMULATION OF MERCURY AND SELENIUM IN CULTURED YELLOWTAIL,
Shimonoseki Univ. of Fisheries (Japan). Dept. of Food Science and Technology.
For primary bibliographic entry see Field 5A.
W80-01068

THE EFFECT OF SEWAGE AND INDUSTRIAL WASTE DISCHARGES ON THE PRIMARY PRODUCTION OF A SHALLOW TURBULENT RIVER,
Vikram Univ., Ujjain (India). School of Studies in Botany.
For primary bibliographic entry see Field 5A.
W80-01069

AN INVESTIGATION ON THE MERCURY CONTAMINATION OF PERSIAN GULF FISH,
Tehran, Univ. (Iran). Dept. of Food Hygiene.
For primary bibliographic entry see Field 5A.
W80-01070

IN VIVO AND IN VITRO EFFECT OF PHENOCLOR DP6 ON DRUG METABOLIZING ACTIVITY IN MULLET LIVER,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
For primary bibliographic entry see Field 5A.
W80-01071

MIREX RESIDUES IN EGGS AND LIVERS OF TWO LONG-LIVED REPTILES (CHRYSEMYS SCRIPTA AND TERRAPENE CAROLINA) IN MISSISSIPPI, 1970-1977,
Mississippi Univ. for Women, Columbus. Dept. of Physical Sciences.
For primary bibliographic entry see Field 5A.
W80-01074

OIL CHANGE IN EXCRETORY PRODUCTS OF MUSSELS (MYTILUS GALLOPROVINCIALIS),
Institute of Biology of the South Seas, Sevastopol (USSR).
For primary bibliographic entry see Field 5A.
W80-01075

SEDIMENT PENETRATION OF AMOCO CADIZ, OIL, POTENTIAL FOR FUTURE RELEASE, AND TOXICITY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 5A.
W80-01076

CELLULAR RESPONSES TO POLYCYCLIC AROMATIC HYDROCARBONS AND PHENOBARBITAL IN MYTILUS EDULIS,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5A.
W80-01077

FAILURE OF OSMOREGULATION WITH APPARENT POTASSIUM INTOXICATION IN MARINE TELEOSTS: A PRIMARY TOXIC EFFECT OF COPPER,
Florida, Univ., Gainesville. Coll. of Veterinary Medicine.
For primary bibliographic entry see Field 5A.
W80-01079

THE RESPIRATORY RESPONSE OF JUVENILE MUD CRABS, RHITHROPANOPEUS HARRISII TO VARIATIONS IN SALINITY AND FOLLOWING SHORT-TERM EXPOSURE TO HALOWAX 1099, A POLYCHLORINATED NAPHTHALENE (PCN),
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-01080

PREDICTING ROTENONE DEGRADATION IN LAKES AND PONDS,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 5A.
W80-01082

RECOVERY OF 14C-LABELLED POLYCHLORINATED BIPHENYLS (PCB) IN FISH TISSUE USING A COMBUSTION AND A SOLUBILIZATION METHOD OF SAMPLE PREPARATION FOR SCINTILLATION ANALYSIS,
Canada Centre for Inland Waters, Burlington (Ontario),
For primary bibliographic entry see Field 5A.
W80-01086

IDENTIFICATION OF TRANS-NONACHLOR IN GOBY-FISH FROM TOKYO BAY,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
For primary bibliographic entry see Field 5A.
W80-01087

BIOLOGICAL AVAILABILITY OF SEDIMENT-BOUND CADMIUM TO THE EDIBLE COCKLE, CERASTODERMA EDULE,
Bristol Univ. (England). Dept. of Inorganic Chemistry.
For primary bibliographic entry see Field 5A.
W80-01088

BENZO(A)PYRENE CONCENTRATIONS IN MUSSELS (MYTILUS EDULIS) FROM YAQUINA BAY, OREGON DURING JUNE 1976-MAY 1978,
Oregon State Univ., Corvallis. Dept. of General Science.
For primary bibliographic entry see Field 5A.
W80-01092

PCB RESIDUES IN BIVALVES AND SEDIMENTS OF RARITAN BAY,
Industrial Environmental Research Lab.-Cincinnati, Edison, NJ.
For primary bibliographic entry see Field 5A.
W80-01093

HATCHING SUCCESS AND LARVAL MORTALITY IN AN ESTUARINE TELEOST, MENIDIA MENIDIA (LINNAEUS), EXPOSED TO CADMIUM IN CONSTANT AND FLUCTUATING SALINITY REGIMES,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W80-01096

MONITORING TRACE ELEMENTS IN THE MUSSEL, MYTILUS EDULIS USING X-RAY ENERGY SPECTROSCOPY,
Simon Fraser Univ., Burnaby (British Columbia).

Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W80-01100

OPERATIONAL SPRAYING OF ACEPHATE TO SUPPRESS SPRUCE BUDWORM HAS MINOR EFFECTS ON STREAM FISHES AND INVERTEBRATES,
Maine Univ. at Orono. Dept. of Zoology.
C. F. Rabeni, and J. G. Stanley.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 327-333, 1979. 3 Fig, 3 Tab, 18 Ref.

Descriptors: *Pesticide toxicity, *Ecosystems, *Pesticide kinetics, Fish physiology, Brook trout, Atlantic salmon, Suckers, Fish behavior, Enzymes, Aquatic insects, Insecticides, Forest management, Invertebrates, Growth rates, Streams, *Acephate, *Acetylcholinestase, *Tissue analysis.

This study examined the effects of spraying of acephate on a stream ecosystem. The specific objectives were to measure: (1) Acetylcholinesterase (AChE) activity of fish brains as an index to direct effect. (2) Examine the effect of spraying on fish feeding. (3) Compare the growth of adult and young-of-the -year salmonids from treated and control streams. (4) Document the effects of spraying on macroinvertebrate standing crop and drift. Brook trout (Salvelinus fontinalis), landlocked (Salmo salar), longnose sucker (Catostomus catostomus) and common sucker (C. commersoni) were captured by electrofishing. Brain AChE activity was depressed in suckers but not salmonids exposed to acephate. Brook trout unexposed to acephate preyed primarily on immature aquatic insects; Ephemeroptera, Plecoptera, Diptera, and Trichoptera. Fish captured 1 and 2 days post-spray consumed significantly more terrestrial forms including beetles, moths, wasps, and spiders. The effect of the insecticide on fish diet was transient. The growth of the different year classes of brook trout and landlocked Atlantic salmon was about the same between the treated and control streams. No unusual growth patterns were evident. The variation in numbers of benthic invertebrates collected using the Surber sampler was high; some standard deviations were as large as the mean. Changes in standing crop of most taxa followed no consistent pattern and did not correlate with increase in the drift, therefore we conclude that population densities of benthos were not affected by the insecticide. (Deal-EIS)
W80-01103

EFFECTS OF SIMAZINE ON THE BLUE-GREEN ALGA ANACYSTIS NIDULANS,
Langston Univ., OK.
R. S. Metha, and K. W. Hawxby.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 319-326, 1979. 5 Fig, 1 Tab, 16 Ref.

Descriptors: *Pesticide toxicity, *Cyanophyta, *Electron microscopy, Algae, Herbicides, Metabolism, Pesticide kinetics, Mode of action, Photosynthesis, Cytological studies, Chemical analysis, Chemical properties, Mortality, Chlorophyll, Biochemistry, *Simazine, *Anacystis, *Organelles.

Anacystis nidulans was studied in an attempt to determine which organelles were affected by the herbicide simazine. A 10-day culture was treated with simazine at a concentration of 10-5M. Samples were removed and studied after 0, 12, 24, 48, and 53 hours following exposure. The effects of simazine on Anacystis were noticeable first on thylakoids and then on PB. The mode of reaction after 12 hr of treatment appeared to be: (1) thylakoids appeared to develop granularity, (2) granular bodies became conspicuous over thylakoids and, as action of simazine became severe (48 hr after treatment) thylakoids appeared empty, distorted, and functionless. The PB became larger, fewer, and appeared membrane bound with increase in time of treatment. The death of a cell was indicated by empty distorted thylakoids, depletion of RNA and disintegration of PB last, compared to other cell organelles. Separate biochemical measurements showed that RNA content in simazine treated cells after 48 hr was less than the control. A decrease in chlorophyll content was also noted in exposed cultures. (Deal-EIS)
W80-01104

TOTAL AND ORGANIC MERCURY IN MARINE FISH OF THE UPPER GULF OF THAILAND,
Chulalongkorn Univ., Bangkok (Thailand). Inst. of Environmental Research.
For primary bibliographic entry see Field 5A.
W80-01105

EFFECTS OF COREXIT 9527 ON THE HATCHABILITY OF MALLARD EGGS,
Fish and Wildlife Service, Laurel MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W80-01107

NUTRIENT DISCHARGE FROM A 90 KM2 WATERSHED,
Danish Soil Conservation Service, Kolding.
J. J. Edens, and S. O. Soldberg.
Progress in Water Technology, Vol 8, No 4-5, p 85-89, 1977. 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Phosphorus, *Nitrogen, *Nutrients, *Water pollution sources, *Agricultural watersheds, *Non-point sources, Denmark, Cycling nutrients, Runoff, Watersheds(Basins), Drainage, Sewerage, Flow, Farms, Agriculture, Farm wastes, Fertilizers, Water pollution.

Agricultural runoff is responsible for most of the nitrogen discharge in a watershed in southwest Denmark. The watershed has a total area of 90 sq km, 74% of which is farmland, 26% is forests and plains. Fewer than one-fourth of the population of 850 have sanitary facilities connected to sewer systems; others drain the sewage into the ground. There is no industry in the watershed. Data was collected once a week for a 24 hour period April 1973-May 1974; parameters include nitrogen compounds, phosphorus compounds, oxygen demand, pH, water flow, water temperature, and precipitation. The average yearly flow is 11.1 l/s/sq km and the total nutrient discharge was 12.9 kg N/ha/yr and 0.55 kg N/ha and 0.17 kg P/ha for the watershed. The farmland is both cultivated and fertilized and one-half of it has artificial drainage. Annual fertilization in the total watershed is 90 kg N/ha and 20 kg P/ha. Farmland, forest, area, precipitation, and groundwater were considered in evaluating the discharge. Nutrient discharge excluding contribution from the population is 12.4 kg N/ha/yr and 0.18 kg P/ha/yr. (Danovich-Wisconsin)
W80-01126

NITROGEN IN ORGANIC MATTER AND FERTILIZER AS A SOURCE OF POLLUTION,
Institute for Soil Fertility, Groningen (Netherlands).
For primary bibliographic entry see Field 5C.
W80-01128

THE INFLUENCE OF NITROGEN FERTILIZERS ON STREAM NITRATE CONCENTRATIONS NEAR ALLISTON, ONTARIO, CANADA,
York Univ., Downsview (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 5C.
W80-01130

MODELS FOR PREDICTING WATER POLLUTION FROM AGRICULTURAL WATERSHEDS,
Science and Education Administration, Chickasha, OK. Southern Great Plains Watershed Research Center.
For primary bibliographic entry see Field 5C.
W80-01133

METHOD AND APPARATUS FOR UTILIZING ACCUMULATED UNDERGROUND WATER IN THE MINING OF SUBTERRANEAN SULPHUR,
Freeport Minerals Co., New York. (Assignee).
For primary bibliographic entry see Field 2F.
W80-01180

ENVIRONMENTAL IMPROVEMENT AT NEROUTSOS INLET, B. C. VOLUME 1 SUMMARY REPORT,
Rayonier Canada (B.C.) Ltd., Port Alice.
For primary bibliographic entry see Field 5A.
W80-01192

ENVIRONMENTAL IMPROVEMENT AT NEROUTSOS INLET, B.C. VOLUME 2 WATER QUALITY AND BIOLOGICAL STUDIES IN NEROUTSOS INLET, B.C.
ITT Rayonier Inc., Shelton, WA. Olympic Research Div
P. G. Corbett, J. P. Campbell, and S. H. Olsen.
Rayonier Canada (B.C.) Limited, December, 1978, 103 p, 20 Fig, 13 Tab, 12 Ref.

Descriptors: *Pulp & paper industry, *Pulp wastes, Water quality, Estuaries, *Vancouver Island, Neroutsos Inlet, Water pollution effects, Dissolved oxygen, Hydrogen ion concentration, Phytoplankton, Diatoms, Protozoa, Primary productivity, Benthos, Intertidal.

Following improvements in waste treatment in 1977, the waste concentration in Neroutsos Inlet and Quatsino Sound improved. Both dissolved oxygen and pH improved although they varied over a wide range. Primary production has increased in 1978. There was an increase in intertidal organisms in the outer fringes of areas bordering the mill. A plankton sampling program indicated that water quality improved in 1978, as indicated by increased numbers and kinds of diatoms. The amount of stalked protozoa was about the same. Phytoplankton grab samples were not useful in evaluating changes in water quality. (Katz-EIS)
W80-01193

5C. Effects Of Pollution

MASOTEN (DYLOX) AS A CONTROL FOR CLAM SHRIMP IN HATCHERY PRODUCTION PONDS,
Fish and Wildlife Service, San Marcos, TX. Fish Cultural Development Center
For primary bibliographic entry see Field 5A.
W80-00802

THE EFFECTS OF HEATED WATER ON WARMWATER FISH IN EARTHEN RACEWAYS,
Alabama Univ., Auburn. Dept. of Fisheries and Allied Aquacultures.
C. J. Turner, J. M. Lawrence, and D. R. Bayne.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 332-342, 1977. 2 Fig, 4 Tab, 17 Ref.

Descriptors: *Heated water, *Toxicity, *Fish populations, Bass, Channel catfish, Sunfishes, Growth rates, Water temperature, Heat resistance, Fish physiology, Fish reproduction, Spawning, Mortality, Fish management, *Shad.

Two-year studies were conducted in 3 earthen raceways. One raceway was maintained at ambient water temperature, 1 had a heated floating plume over 60% of the surface, and 1 was maintained at near heated water discharge temperature. Average water temperatures ranging up to 36.7C were not lethal for any fish species tested. With the possible exception of threadfin shad no difference in long-term survival of any species was detected, but when the entire population was considered as a whole, survival of fishes confined to the highest temperatures was reduced. Growth rates of largemouth and spotted basses, channel catfish, redear sunfish, and gizzard shad in at least 1 of the heated water treatments exceeded growth in the control Total standing crop and growth rates of bluegill

and drum were lowest in the treatment with highest water temperatures. Little difference was seen between the control and the treatment with a floating heated water plume. (Deal-EIS)
W80-00803

EVALUATION OF AN AIR-BUBBLE CURTAIN TO REDUCE IMPINGEMENT AT AN ELECTRIC GENERATING STATION,
Texas Instruments Inc., Dallas, TX. Ecological Services.
For primary bibliographic entry see Field 5A.
W80-00804

SALINITY STRESS AND SWIMMING PERFORMANCE OF SPOTTED SEATROUT,
Texas, Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5A.
W80-00805

A RECURRENCE MODEL FOR THE PREDICTION OF DDT FLUX IN ATLANTIC MENHADEN,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
For primary bibliographic entry see Field 5B.
W80-00806

EFFECTS OF MASOTEN (DYLOX) ON PLANKTON IN EARTHEN PONDS,
Fish and Wildlife Service, San Marcos, TX. Fish Cultural Development Center.
For primary bibliographic entry see Field 5A.
W80-00807

EFFECTS OF A PUMPED STORAGE HYDROELECTRIC PLANT ON RESERVOIR TROUT HABITAT,
Fish and Wildlife Service, Clemson, SC. Southeast Reservoir Investigations.
For primary bibliographic entry see Field 5A.
W80-00808

REPRODUCTION REPRESSION OF LARGEMOUTH BASS IN A HEATED RESERVOIR,
Texas Parks and Wildlife Dept., San Antonio.
For primary bibliographic entry see Field 5A.
W80-00810

MIGRATION OF SAUGER PAST A THERMAL DISCHARGE IN MELTON HILL RESERVOIR,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries and Wildlife Development.
For primary bibliographic entry see Field 5A.
W80-00811

HEAT TOLERANCE OF FREE-LIVING ESTUARINE ANIMALS TO PREDICT THEIR SURVIVAL IN HEATED EFFLUENTS,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
K. S. Chung, and K. Strawn.
Proceedings of the Thirty-First Annual Conference Southeastern Association of Fish and Wildlife Agencies, Vol 31, p 612-617, 1977. 1 Fig, 20 Ref.

Descriptors: *Heat resistance, *Toxicity, *Entrainment, Thermal pollution, Seasonal, Mortality, Thermal powerplants, Outlets, Cooling waters, Water temperature, Crustaceans, Animal physiology, Fish physiology, Crabs, Thermal stress, Bacliff, Texas, P. H. Robinson Generating Station, Galveston Bay.

Individual heat resistance times were determined in 180 min experiments during June 1974 through September 1975 for 8 species of crustaceans and 47 fishes taken directly from the intake canal of the P. H. Robinson Generating Station, Bacliff, Texas. Individual resistance times increased with an increase in capture temperature and with a decrease in test temperature. June-September is the most thermally critical period of the year for animals transported by the power plant from intake water and exposed to hot discharge effluent. During the rest of the year, nearly all organisms survived 3 h at temperatures higher than average discharge canal temperature. (Deal-EIS)
W80-00812

SOME EFFECTS OF DREDGED MATERIAL DISPOSAL ON BENTHIC INVERTEBRATES AND SHOREBIRDS IN GRAYS HARBOR,
Washington State Dept. of Game, Aberdeen.
R. Albright, and J. L. Smith.
In: Proceedings of the Symposium on Terrestrial and Aquatic Ecological Studies of the Northwest, March 26-27, 1976, EWSC Press, Chenney, Washington, p 233-240 (1976). 1 Fig, 8 Ref.

Descriptors: *Dredging, *Dredge spoils, *Intertidal areas, Benthos, Washington, Grays Harbor, Benthic invertebrates, *Shore birds, Clams, Amphipoda, Conophium, Dunlin, Western sandpipers, Red knots, Dowitchers, Elevation.

Corophium stimpsoni was the numerically dominant benthic invertebrate occupying the intertidal zone in the inner portions of Grays Harbor, Washington. Other important invertebrates included clams, an amphipod, the cumacean Leptocuma sp. and several polychaete species. Dunlin were the most abundant of the seven species of shorebirds in the area, feeding primarily on C. stimpsoni. Western Sandpipers, Red Knots, and Dowitchers were also numerous. As many as 70,000 small shorebirds used the area during migrations. Elevation was increased by a mean of 0.85 m per station in the disposal site during the 1975 disposal operation. After dredge disposal, all stations were over 2.13 m above MLLW, and all but one over 2.44 m. As a result, the mean number of benthic invertebrate species per station was decreased by 61.6 percent compared to an adjacent contrast area. The mean number of individuals and biomass were reduced by at least 96.8 percent and a change in species composition occurred. Sampling in other areas showed that the number of benthic invertebrates, especially C. stimpsoni, was reduced at elevations above +2.13 m. The mean number of C. stimpsoni after disposal was 22 per sq m at the disposal site, while the adjacent contrast area had a mean of 6063 C. stimpsoni per sq m. The mean numbers of feeding shorebirds were at least 100 times higher below +2.13 m than above that elevation at the disposal area. Seven shorebird species were observed feeding below +2.13 m while only three fed above that elevation. (Katz-EIS)
W80-00813

EFFECTS OF GAS SUPERSATURATION ON FISH IN THE COLUMBIA RIVER,
National Marine Fisheries Service Seattle, WA.
For primary bibliographic entry see Field 5A.
W80-00814

ORGANOTIN RESISTANCE IN GREEN SEAWEEDS,
Leeds Univ. (England). Dept. of Plant Sciences.
M. E. Callow, P. A. Millner, and L. V. Evans.
In: Proceedings of the Ninth International Seaweed Symposium, A. Jensen and J. R. Stein, Eds., Science Press, Princeton, p 191-197, 1977. 3 Fig, 6 Ref.

Descriptors: *Toxicity, *Respiration, *Marine plants, Metals, Absorption, Photosynthesis, Organic compounds, Membrane processes, Proteins, Inhibition, Fouling, Metabolism, Plant physiology, Tin, *Organotins, *Biocides, *Seaweeds, *Enteromorpha, *Ulothrix.

The degree of inhibition of respiratory oxygen uptake in both Enteromorpha intestinalis and Ulothrix flacca spores was similar at each of the concentrations of triphenyltin chloride (SnPh3Cl) used. However, the inhibition of photosynthetic oxygen evolution was greater in Enteromorpha than in Ulothrix over the same concentration range. Uptake of 113SnPh3Cl by Enteromorpha spores was greater in the light than in the dark, whilst in Ulothrix the converse situation was found. Pre-incubation of Ulothrix spores with CCCP (carbonyl cyanide, m-chlorophenylhydrazone) in the light resulted in increased uptake of SnPh3Cl. The possible operation of an active detoxification mechanism in Ulothrix is discussed. (Deal-EIS)
W80-00815

HEAVY METAL EXCHANGE BY ASCOPHYLLUM NODOSUM (PHAEOPHYCEAE) PLANTS IN SITU,
Trondheim Univ. (Norway). Inst. of Marine Biochemistry.
For primary bibliographic entry see Field 5B.
W80-00816

AUTOMATIC CULTURE SYSTEMS FOR GROWING LAMINARIA SACCHARINA (PHAEOPHYCEAE) AND TESTING THE EFFECTS OF POLLUTANTS,
Biologische Anstalt Helgoland, Hamburg (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W80-00817

EFFECT OF PULP MILL EFFLUENT ON PRODUCTIVITY OF SEAWEEDS,
Nova Scotia Research Foundation, Dartmouth.
For primary bibliographic entry see Field 5A.
W80-00818

COMPOSITION OF BENTHIC MARINE ALGAE IN RELATION TO POLLUTION IN THE SETO INLAND SEA, JAPAN,
Kobe Univ. (Japan). Dept. of Botany.
For primary bibliographic entry see Field 5A.
W80-00819

SENSITIVITY OF SOME BROWN ALGAL REPRODUCTIVE STAGES TO OIL POLLUTION,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W80-00820

AN ASSESSMENT OF DDT TOXICITY ON OSMOREGULATION AND GILL NA,K-ATPASE ACTIVITY IN THE BLUE CRAB,
Emporia State Univ., KS. Div. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-00822

EXCRETION OF THE LAMPRICIDE BAYER 73 BY RAINBOW TROUT,
Fish and Wildlife Service, La Crosse, WI. Fish Control Lab.
For primary bibliographic entry see Field 5B.
W80-00824

RELATIONSHIP OF THE PHYSIOLOGY OF AQUATIC ORGANISMS TO THE LETHALITY OF TOXICANTS: A BROAD OVERVIEW WITH EMPHASIS ON MEMBRANE PERMEABILITY,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
For primary bibliographic entry see Field 5A.
W80-00825

RESPIRATORY ACTIVITY OF FISH AS A PREDICTOR OF CHRONIC FISH TOXICITY VALUES FOR SURFACTANTS,
Proctor and Gamble Co., Cincinnati, OH. Ivorydale Technical Center.
For primary bibliographic entry see Field 5A.
W80-00826

USE OF LUMINESCENT BACTERIA FOR DETERMINING TOXICITY IN AQUATIC ENVIRONMENTS,
Beckman Instruments, Inc., Carlsbad, CA.
For primary bibliographic entry see Field 5A.
W80-00827

TAINT THRESHOLD OF DIPHENYL OXIDE IN RAINBOW TROUT,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
For primary bibliographic entry see Field 5A.
W80-00828

A CHRONIC TOXICITY TEST WITH THE MARINE COPEPOD ACARTIA TONSA,
United States Testing Co., Inc., Hoboken, NJ.
For primary bibliographic entry see Field 5A.
W80-00830

USE OF THE GRASS SHRIMP (PALAEMONETES PUGIO) IN A LIFE-CYCLE TOXICITY TEST,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-00831

UPTAKE, DEPURATION, AND TOXICITY OF HEXAMETHYLPHOSPHORAMIDE IN AQUATIC ORGANISMS,
Haskell Lab. for Toxicology and Industrial Medicine, Newark, DE.
For primary bibliographic entry see Field 5A.
W80-00833

DISTRIBUTION OF BENTHOS IN RELATION TO THE SULFIDE-CONTENT IN THE BOTTOM SEDIMENTS OF MIXO-POLYHALINE LAKE NOTORO, HOKKAIDO,
Hokkaido Univ., Hako-date (Japan). Lab. of Marine Culture.
For primary bibliographic entry see Field 5A.
W80-00835

ACUTE TOXICITY OF VANADIUM TO TWO SPECIES OF FRESHWATER FISH,
University of Southern California, Los Angeles. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-00836

TOXICITY OF FOUR SYNTHETIC PYRETHROID INSECTICIDES TO RAINBOW TROUT,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
For primary bibliographic entry see Field 5A.
W80-00837

EMBRYOTOXIC EFFECTS OF CRUDE OIL CONTAINING NICKEL AND VANADIUM IN MALLARDS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W80-00838

EVIDENCE FOR THE PROTECTIVE EFFECT OF METALLOTHIONEINS AGAINST INORGANIC MERCURY INJURIES TO FISH,
Liege Univ. (Belgium). Lab. d'Oceanogolie.
For primary bibliographic entry see Field 5A.
W80-00839

ENVIRONMENTAL BROMINE IN FRESHWATER AND FRESHWATER ORGANISMS: FACTORS AFFECTING BIOACCUMULATION,
Middle Tennessee State Univ., Murfreesboro. Dept. of Chemistry and Physics.
For primary bibliographic entry see Field 5A.
W80-00840

ACUTE ENDRIN TOXICITY ON OXIDASES OF OPHIOCEPHALUS PUNCTATUS (BLOCH),
Hindu Coll., Moradabad (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00842

STUDIES ON THE DEPURATION OF CADMIUM AND COPPER BY THE AMERICAN OYSTER CRASSOSTREA VIRGINICA,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5B.
W80-00843

POLLUTANT LEVELS IN THE GREAT SKUA CATHARACTA SKUA,
Durham Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-00845

ORGANOCHLORINE RESIDUES IN EGGS OF THE ENDANGERED AMERICAN CROCODILE (CROCODYLUS ACUTUS),
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W80-00848

ABERRATIONS IN THE NEUROSECRETORY CELLS OF A FRESHWATER PULMONATE, INDOPLANORBIS EXUSTUS, CHRONICALLY EXPOSED TO SUBLETHAL CONCENTRATION OF TWO MOLLUSCICIDES, BACL2 AND CUSO4,
Marathwada Univ., Aurangabad (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00849

EFFECTS OF IN VIVO CADMIUM EXPOSURE ON ATPASSES IN GILL OF THE LOBSTER, HOMARUS AMERICANUS,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
For primary bibliographic entry see Field 5A.
W80-00851

PARATHION CAUSES SECONDARY POISONING IN A LAUGHING GULL BREEDING COLONY,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
For primary bibliographic entry see Field 5A.
W80-00854

OCCURRENCE OF PCB RESIDUES IN BURBOT (LOTA LOTA) AND LAKE TROUT (SALVELINUS NAMAYCUSH) FROM THE CHURCHILL FALLS POWER DEVELOPMENT AREA,
Department of Fisheries and Environment, Halifax (Nova Scotia).
For primary bibliographic entry see Field 5A.
W80-00856

TOTAL RESIDUAL CHLORINE: THE EFFECT OF SHORT-TERM EXPOSURE ON THE EMERALD SHINER NOTROPIS ATHERINOIDES (RAFINESQUE),
Minnesota Pollution Control Agency, Roseville.
For primary bibliographic entry see Field 5A.
W80-00857

COMBINED EFFECTS OF TEMPERATURE, SALINITY AND CADMIUM ON DEVELOPMENT, GROWTH AND MORTALITY OF MYTILUS EDULIS LARVAE FROM THE WESTERN BALTIC SEA,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
For primary bibliographic entry see Field 5B.
W80-00858

TOXICITY AND TISSUE UPTAKE OF METHYLMERCURY ADMINISTERED INTRAPERITONEALLY TO RAINBOW TROUT (SALMO GAIRDNERI RICHARDSON),
Alberta Univ., Edmonton. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00859

EFFECT OF A PCB (AROCLOR 1254) ON THE STRIPED HERMIT CRAB, CLIBANARIUS VITTATUS (ANOMURA: DIOGENIDAE) IN STATIC BIOASSAYS,
Texas A and M Univ., Galveston. Dept. of Biology.
R. G. Stahl, Jr.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 91-94, 1979. 13 Ref.

Descriptors: *Aroclors, *Crabs, *Toxicity, Polychlorinated biphenyls, Mortality, Bioassay, Lethal limit, Animal physiology, Resistance, Crustaceans, Hermit crabs.

Hermit crabs were exposed to one of seven concentrations of Aroclor 1254 (3, 5, 10, 15, 20, 25 and 30 microgram/L) for up to 96h. Within the concentrations tested no mortalities were observed. However, the crabs exposed to the three higher concentrations were less active than those in lower concentrations. A further exposure to 300 microgram/L Aroclor 1254 failed to produce mortality in 96h in crabs already exposed to 30 microgram/L. (Deal-EIS)
W80-00860

SEPARATE AND JOINT TOXICITY TO RAINBOW TROUT OF SUBSTANCES USED IN DRILLING FLUIDS FOR OIL EXPLORATION,
Guelph, Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-00864

INFLUENCE OF SALINITY AND CADMIUM ON CAPSULE STRENGTH IN PACIFIC HERRING EGGS,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 5A.
W80-00865

INFLUENCE OF SALINITY AND CADMIUM ON THE VOLUME OF PACIFIC HERRING EGGS,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 5A.
W80-00866

FLUXES OF PARTICULATE CARBON, NITROGEN, AND PHOSPHORUS IN THE UPPER WATER COLUMN OF THE NORTHEAST PACIFIC,
Moss Landing Marine Lab., CA.
G. A. Knauer, J. H. Martin, and K. W. Bruland.
Deep-Sea Research, Vol 26A, No 1, p 97-108, January 1979. 1 Fig, 4 Tab, 31 Ref.

Descriptors: *Carbon, *Nitrogen, *Phosphorus, *Cycling nutrients, *Pacific Ocean, Pacific Coast Region, Chemical analysis, Nutrients, Biodegradation, Degradation(Decomposition), Nutrient budgets, Cycles, Upwelling, Coasts, Oceans, Water chemistry, Nutrient transport, Primary productivity, Chemical degradation, On-site data collections.

Particulate C, N, and P fluxes were investigated and in-situ rates of change in the upper 1000 m of the water column estimated by using three identical trap systems set at 50, 250, and 700 m in coastal waters, and 75, 575, and 1050 m in open Pacific Ocean waters. During high coastal productivity periods, C, N, and P fluxes of 36, 4.1, and 0.19 mmole sq m d were observed at 50 m. These values decreased with depth to 9.6 C, 0.9 N, and 0.053 P mmole sq m d at 700 m. Non-welling fluxes at 50 m were lower than these observed at 700 m during high productivity. Fluxes observed in open ocean were lower still, ranging from 5.7 C, 0.41 N, and 0.014 P at 75 m to 1.0 C, 0.034 N, and 0.0011 P (mmole sq m d) at 1050 m. Under upwelling, C:N:P ratios were 180:18:1, while C:N values were 10:1. The ratios suggest that the material falling into the traps are similar to living phytoplankton. Open ocean N:P ratios were similar to those observed under non-upwelling conditions (30), while C:P ratios were considerably higher (from 410 at 75 m to 910 at 1050 m), suggesting that both P and

N loss occurs with depth while C remains constant. A number of identifiable fecal pellet were collected in the traps: 320,000 (upwelling coast), 17,000 (non-upwelling coast) pellets sq m d at 50 m, compared to 1,400 pellets sq m d at 75 m open ocean. The fluxes are consistent with in-situ DO, N, and P rates of change necessary to account for their vertical distribution. (Danovich-Wisconsin)
W80-00967

A PRELIMINARY STUDY OF ZOOPLANKTON SOUND SCATTERING LAYERS IN BALSFJORDEN: STRUCTURE, ENERGETICS, AND MIGRATIONS,
Tromso Univ. (Norway). Inst. of Biology and Geology.
C. C. E. Hopkins, S. Falk-Petersen, K. Tande, and H. C. Eilertsen.
SARSIA, Vol 63, No 4, p 255-264, November 1978. 3 Fig, 2 Tab, 32 Ref.

Descriptors: *Zooplankton, *Diel migration, *Sound waves, *Spatial distribution, *Ecological distribution, *Balsfjorden, Norway, Light, Migration, Biorhythms, Diurnal, Acoustics, Copepods, Biological communities, Distribution, Norway, Fjords, Arctic, Biomass, Aquatic life.

Zooplankton sound scattering in Balsfjorden, a Norwegian fjord north of the Arctic circle, is dependent not only on spatial distribution, displacement volume, and biomass of individual zooplankton species, but also upon complex synergistic action of the component populations. The paper presents the preliminary results of a combination of acoustic and biological sampling of the dense 120 kHz sound scattering layer (SSL) in Balsfjorden over a 24 hr period April 5-6, 1977. Diurnal vertical migration of the SSL involved ascent towards the surface (0-50 m) from a deeper day depth (100-150 m) at about noon, followed by descent from the surface around midnight before finally approaching the previous day depth again. Migration is related to changes in incident and sub-surface radiation intensity. The SSL is composed of zooplankters present in large numbers and biomass. The general absence of fish, as noted from the 38 kHz sounder and pelagic trawl, indicates that 120 kHz sound scattering is a direct result of increased zooplankton concentration. Copepods account for up to 72% of the total SSL biomass and S. elegans are also large and abundant. Dominant zooplankters are changeable but an increased abundance and biomass of Thysanoessa spp. is always positively associated with the SSL. M. longa migrations are positively associated with SSL movement, the result not only of an individual species, but a community response representing different trophic levels. (Danovich-Wisconsin)
W80-00983

NUTRIENT CHEMISTRY OF A LARGE, DEEP LAKE IN SUBARCTIC ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
J. D. LaPerriere, T. Tilsworth, and L. A. Casper.
EPA-600/78-088, September 1978. 128 p, 25 Fig, 26 Tab, 74 Ref, 1 Append.

Descriptors: *Subarctic, *Water quality, *Nutrients, *Limnology, *Mathematical models, *Lake Harding(AK), Alaska, Lakes, Water chemistry, Cycling nutrients, Zooplankton, Benthic fauna, Submerged plants, Rooted aquatic plants, Plankton, Growth rates, Productivity, Recreation, Oligotrophy.

Lake Harding in central Alaska was investigated 1973 to 1975; water quality was assessed and future development environmental effects were predicted. Lake Harding is dimictic, but it sometimes does not reach complete oxygen saturation in spring because thermal stratification is not broken due to wind absence. Plant nutrient concentrations are moderate. The lake supports low algal production (95.6 gm/sq/m/yr) comparable to other high latitude oligotrophic lakes. Vascular aquatic plant growth, 1.35 gm/sq/m/yr, is less important than algal growth. Zooplankton biomass is highest in late summer amounting to 10 times winter values. With 988 ha, 43 m maximum depth and 16 m mean depth, it is the closest recreational lake near Fairbanks, Alaska. Extreme annual temperature variations produce thick ice cover most months broken by nearly temperate summer conditions. Annual heat budget is 19,600 cal/cm. Algal heterotrophy is important; phytoplankton under ice are dormant, indicated by very low productivity; however, chlorophyll-a measurements reveal high standing crops. A lake management model adequately describes nutrient loading effects on algal growth; peak growth occurs under spring ice. Bacterial contamination detected between 1966 and 1971 was due to improper sewage disposal methods at recreational areas; after proper methods were constructed in 1972, no excessive counts were recorded. (Danovich-Wisconsin)
W80-00984

A PROCEDURE FOR THE PREDICTION OF NITRATE LEVELS IN WATER SUPPLIES IN THE UNITED KINGDOM,
Department of the Environment, Reading (England). Central Water Planning Unit.
M. J. Reeves.
Progress in Water Technology, Vol 8, No 4-5, p 161-177, 1977. 3 Fig, 4 Tab, 42 Ref.

Descriptors: *United Kingdom, *Methodology, *Nitrates, *Forecasting, *Model studies, *Water supply, England, Chalk, Water sources, Watersheds(Basins), Nitrogen, Aquifers, Fertilizers, Rivers, Groundwater, Systems analysis, Hydrology, Hydrogeology, River basins, Simulation analysis, Analytical techniques, Agriculture, Crop production.

A new procedure indicates that nitrate levels in United Kingdom rivers respond more rapidly to changes in agricultural practices than do groundwater sources; monitoring of rivers may thus give advance notice of nitrate trends in aquifers. Sample calculations were made for a generalized chalk catchment in eastern England based on quantitative assumptions regarding nitrogen cycle, catchment hydrology and hydrogeology, and agricultural practices. Nitrate level in the chalk aquifer increased gradually from about 35 mg/l in 1950 to 50 mg/l in 1970, predicted to rise to 80 mg/l if agricultural practices persist. Over the same period nitrate levels in area rivers rose from about 30 mg/l to 50 mg/l, but no further increase is expected at a sustained level of agricultural development. The procedure was devised through initial analysis of the system as a whole with identification of physical mechanisms by which system components operate and interact. These mechanisms include those controlling nitrate additions and losses and those controlling nitrate movement rate. The second step was to construct a model able to simulate the system. Areas requiring additional research include rates of vertical movement and dispersion of nitrate in soils and unsaturated strata, variations in rainfall nitrogen content, nitrogen immobilized by unharvested crops, annual losses by soil denitrification, denitrification in aquifers, and nitrate loss in streams and rivers. (Lynch-Wisconsin)
W80-00993

EFFECTS ON HATCHING IN LITTORINA LITTOREA AFTER AN OIL SPILL,
Institute of Marine Research. Bergen (Norway).
For primary bibliographic entry see Field 5B.
W80-01043

SMALL OIL SPILL KILLS 10-20000 SEABIRDS IN NORTH NORWAY,
Tromoe Univ. (Norway). Dept. of Zoology and Marine Biology.
R. T. Barrett.
Marine Pollution Bulletin, Vol 10, p 253-255, 1979. 1 Fig, 2 Tab, 3 Ref.

Descriptors: *Oil spills, *Water birds, *Mortality, Norway, Oil pollution, Organic compounds, Toxicity, Ducks, Animal populations, Reproduction, Water pollution effects, *Uria, *Guillemots, *Auks.

An estimated 10-20,000 seabirds were killed by a very small oil spill off the coast of North Norway in March 1979. Despite the fact that over 90% of these were Brunnich's Guillemots Uria lomvia, the breeding population of this species was not considered to have been seriously threatened by this spill. On the other hand, this episode did illustrate how extremely vulnerable certain seabird species are to oil. (Deal-EIS)
W80-01044

FINE PARTICULATE ORGANIC CARBON OUTPUT FROM FENS AND ITS EFFECT ON BENTHIC MACROINVERTEBRATES,
California Univ., Berkeley. Dept. of Forestry and Conservation.
For primary bibliographic entry see Field 5A.
W80-01045

EFFECTS OF A THERMAL DISCHARGE ON REPRODUCTIVE CYCLES IN MYTILUS EDULIS AND MYTILUS CALIFORNIANUS (MOLLUSCA, BIVALVIA),
California Univ., Berkeley. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-01046

NITROGEN GAS SUPERSATURATION DURING ARTIFICIAL AERATION AT LAKE CASITAS, CALIFORNIA,
Limnological Associates, Kaneohe, HI.
For primary bibliographic entry see Field 5A.
W80-01050

LONG-TERM RESIDUAL EFFECTS OF POLYETHYLENEIMINE ON DAPHNIA,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 5A.
W80-01051

AN OPTICAL METHOD FOR RECORDING CARDIAC RHYTHM IN DAPHNIA,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Tsellyulozno-Bumazhnoi Promyshlennosti, Leningrad (USSR).
For primary bibliographic entry see Field 5A.
W80-01053

THE CHRONIC EFFECT OF ALKALI ON THE GROWTH, DEVELOPMENT AND FECUNDITY OF THE GUPPY,
Tsentralnyi Gosudarstvennyi Nauchno-Issledovatelskii Inst. Ozernogo i Rechnogo Rybnogo Khozyaistva, Baku (USSR). Azerbaijan Branch.
For primary bibliographic entry see Field 5A.
W80-01054

RED SWAMP CRAYFISH: SHORT-TERM EFFECTS OF SALINITY ON SURVIVAL AND GROWTH,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5A.
W80-01056

PHYSIOLOGICAL MECHANISMS OF THE ACTION OF TOXIC SUBSTANCES, AND ADAPTATION OF AQUATIC ANIMALS TO THEM,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 5A.
W80-01057

TOXICITY OF SOME HEAVY METALS FOR DAPHNIA MAGNA STRAUSS, AS A FUNCTION OF TEMPERATURE,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W80-01059

THE MARINE LIFE OF AN OFFSHORE OIL PLATFORM,
International Biological Consultants, Encinitas, CA.

For primary bibliographic entry see Field 5A.
W80-01060

ABORTION EFFECT IN CORALS INDUCED BY OIL POLLUTION,
Tel Aviv Univ. (Israel). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-01061

UPTAKE AND ACCUMULATION OF CADMIUM BY OPHRYOTROCHA DIADEMA (POLYCHAETA),
Biologische Anstalt Helgoland Hamburg. (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W80-01062

EFFECTS OF OXYGEN TENSION ON PUMPING, FILTRATION AND OXYGEN UPTAKE IN THE ASCIDIAN PHALLUSIA MAMMILLATA,
Paris-6 Univ. (France). Lab. Arago.
For primary bibliographic entry see Field 5A.
W80-01063

PERSISTENCE OF POLYCHLORINATED BIPHENYLS AND 1,1-DICHLORO-2,2-BIS(P-CHLOROPHENYL) ETHYLENE (P,P'-DDE) WITH AGE IN LAKE TROUT AFTER 8 YEARS,
Cornell Univ., Ithaca, NY. Dept. of Food Science.
For primary bibliographic entry see Field 5A.
W80-01064

TEMPERATURE AND SALINITY EFFECTS ON THE ACUTE TOXICITY OF CADMIUM TO LAOMEDEA LOVENI (HYDROZOA),
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
For primary bibliographic entry see Field 5A.
W80-01065

TOXICITY OF COPPER COMPOUNDS FOR CHLORELLA PYRENOIDOSA BEYER,
Moscow City Council (USSR). Inst. for the Design and Planning of the Water Supply and Sewer Systems.
For primary bibliographic entry see Field 5A.
W80-01066

IN VIVO AND IN VITRO EFFECT OF PHENOCLOR DP6 ON DRUG METABOLIZING ACTIVITY IN MULLET LIVER,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
For primary bibliographic entry see Field 5A.
W80-01071

ACUTE TOXICITY TO SELENASTRUM CAPRICORNUTUM OF AROMATIC COMPOUNDS FROM COAL CONVERSION,
Oak Ridge National Lab. TN.
For primary bibliographic entry see Field 5A.
W80-01072

EFFECT OF SELECTED WATER TOXICANTS AND OTHER CHEMICALS UPON ADENOSINE TRIPHOSPHATASE ACTIVITY IN VITRO,
Environmental Research Lab. Duluth, MN.
For primary bibliographic entry see Field 5A.
W80-01073

MIREX RESIDUES IN EGGS AND LIVERS OF TWO LONG-LIVED REPTILES (CHRYSEMYS SCRIPTA AND TERRAPENE CAROLINA) IN MISSISSIPPI, 1970-1977,
Mississippi Univ. for Women, Columbus. Dept. of Physical Sciences.
For primary bibliographic entry see Field 5A.
W80-01074

SEDIMENT PENETRATION OF AMOCO CADIZ, OIL, POTENTIAL FOR FUTURE RELEASE, AND TOXICITY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 5A.
W80-01076

CELLULAR RESPONSES TO POLYCYCLIC AROMATIC HYDROCARBONS AND PHENOBARBITAL IN MYTILUS EDULIS,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5A.
W80-01077

THE RELATIONSHIP BETWEEN THE COPPER COMPLEXING CAPACITY OF SEA WATER ND COPPER TOXICITY IN SHRIMP ZOEAE,
Battelle Pacific Northwest Labs., Sequim, WA Marine Research Lab.
For primary bibliographic entry see Field 5A.
W80-01078

FAILURE OF OSMOREGULATION WITH APPARENT POTASSIUM INTOXICATION IN MARINE TELEOSTS: A PRIMARY TOXIC EFFECT OF COPPER,
Florida, Univ., Gainesville. Coll. of Veterinary Medicine.
For primary bibliographic entry see Field 5A.
W80-01079

THE RESPIRATORY RESPONSE OF JUVENILE MUD CRABS, RHITHROPANOPEUS HARRISII TO VARIATIONS IN SALINITY AND FOLLOWING SHORT-TERM EXPOSURE TO HALOWAX 1099, A POLYCHLORINATED NAPHTHALENE (PCN),
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-01080

EFFECTS OF LOGGING ON STREAM ENVIRONMENTS AND FAUNAS IN NELSON,
Marine Dept., Wellington (New Zealand). Fisheries Research Div.
For primary bibliographic entry see Field 5A.
W80-01081

AN INVESTIGATION INTO THE EFFECTS OF THE PISCICIDE ANTIMYCIN A ON THE FISH AND INVERTEBRATES OF A SCOTTISH STREAM,
Freshwater Fisheries Lab., Pitlochry (Scotland).
For primary bibliographic entry see Field 5A.
W80-01083

THE EFFECT OF AMMONIA ON THE GROWTH OF JUVENILE DOVER SOLE, SOLEA SOLEA (L.) AND TURBOT, SCOPHTHALMUS MAXIMUS (L.),
Ministry of Agriculture, Fisheries and Food, Port Erin (England). Fisheries Lab.
For primary bibliographic entry see Field 5A.
W80-01084

TOLERANCE OF DEVELOPING SALMONID EGGS AND FRY TO NITRATE EXPOSURE,
Fish and Wildlife Service, Portland, OR. Div. of Ecological Services.
For primary bibliographic entry see Field 5A.
W80-01085

EXTRACTION AND GAS-LIQUID CHROMATOGRAPHIC ANALYSIS OF CHLORPHOXIM IN WATER AND FISH,
Center for Disease Control, Atlanta, GA. Environmental Health Services, Div.
For primary bibliographic entry see Field 5A.
W80-01089

AN EVALUATION OF THE ACUTE TOXICITY TO AQUATIC BIOTA OF A COAL CONVERSION EFFLUENT AND ITS MAJOR COMPONENTS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5A.
W80-01090

EFFECTS OF CHRONIC EXPOSURE TO ZINC ON REPRODUCTION IN THE GUPPY (POECILIA RETICULATA),
Alberta Univ., Edmonton. (Canada) Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-01091

EFFECTS OF ALUMINUM AND NICKEL ON SURVIVAL AND REPRODUCTION IN POLYCHAETOUS ANNELIDS,
California State Univ., Long Beach. Dept. of Biology
For primary bibliographic entry see Field 5A
W80-01094

TOXICITY OF SODIUM PENTACHLOROPHENATE TO JUVENILE CHINOOK SALMON UNDER CONDITIONS OF HIGH LOADING DENSITY AND CONTINUOUS-FLOW EXPOSURE,
British Columbia Dept. of Recreation and Conservation, Victoria. Fish and Wildlife Branch
For primary bibliographic entry see Field 5A
W80-01095

HATCHING SUCCESS AND LARVAL MORTALITY IN AN ESTUARINE TELEOST, MENIDIA MENIDIA (LINNAEUS), EXPOSED TO CADMIUM IN CONSTANT AND FLUCTUATING SALINITY REGIMES,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W80-01096

EFFECT OF BARITE ON MEIOFAUNA IN A FLOW-THROUGH EXPERIMENTAL SYSTEM,
Texas Instruments Inc., Buchanan, NY
For primary bibliographic entry see Field 5A
W80-01097

SUBLETHAL EFFECTS OF HEAVY METAL CONTAMINATED SEDIMENTS ON THE BIVALVE MACOMA BALTHICA (L.),
British Columbia Univ., Vancouver. Inst. of Oceanography.
For primary bibliographic entry see Field 5A.
W80-01098

EFFECTS OF WOOD WASTE ON SAND-BED BENTHOS,
British Columbia Univ., Vancouver. Dept. of Biology.
K. E. Conlan, and D. V. Ellis.
Marine Pollution Bulletin, Vol 10, p 262-267, 1979. 4 Fig, 1 Tab, 19 Ref

Descriptors: *Wood wastes, *Toxicity, *Benthic fauna, Polychaetes, Crustaceans, Industrial wastes, Biological communities, Dominant organisms, Aquatic populations, Biomass, Mode of action, Bark, *Species diversity, Lumbering

The impact on benthos of wood (abraded bark and wood) at an industrial log handling site was examined through the medium of the infauna of a shallow sand bed (depth 4-11 m). This sand bed supported a diverse biological community with abundant suspension-feeding polychaetes and bivalves Deposition of more than a 1 cm layer of wood waste produced noticeable losses of these suspension feeders. The impact increased progressively with amount of waste deposited. The community inhabiting thickest deposit (up to 15 cm measured) had virtually lost the suspension feeding trophic pathway, was reduced in diversity and biomass, and was dominated by only a few abundant deposit-feeding crustaceans and polychaetes, e.g. Nebalia pugettensis and Dorvillea annulata. (Deal--EIS)
W80-01099

THE EMBRYONIC DEVELOPMENT AND THE THERMAL EFFECTS ON THE DEVELOPMENT OF THE MOUNTAIN WHITEFISH, PROSOPIUM WILLIAMSONI (GIRARD),
Utah Cooperative Fishery Unit, Logan.
For primary bibliographic entry see Field 5A.
W80-01101

UPTAKE OF METHOXYCHLOR FROM FOOD AND WATER BY THE AMERICAN TOAD (BUFO AMERICANUS),
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W80-01102

OPERATIONAL SPRAYING OF ACEPHATE TO SUPPRESS SPRUCE BUDWORM HAS MINOR EFFECTS ON STREAM FISHES AND INVERTEBRATES,
Maine Univ. at Orono. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-01103

EFFECTS OF SIMAZINE ON THE BLUE-GREEN ALGA ANACYSTIS NIDULANS,
Langston Univ., OK.
For primary bibliographic entry see Field 5B.
W80-01104

CHARACTERISTICS OF SPORT FISHING ACTIVITY IN THREE WARM WATER DISCHARGES,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries, and Wildlife Development.
For primary bibliographic entry see Field 5A.
W80-01106

SOME EFFECTS OF CERTAIN METALS ON DEVELOPMENT AND MORTALITY WITHIN THE MOULT CYCLE OF CRANGON CRANGON(L.),
Hull, Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-01108

PRODUCTION AND BIOMASS OF CLADOPHORA PROLIFERA (CHLOROPHYTA, CLADOPHORALES) IN BERMUDA,
Allegheny Coll., Meadville, PA. Dept. of Biology.
S. D. Bach, and M. N. Josselyn.
Botanica Marina, Vol 22, p 163-168, 1979. 4 Fig, 2 Tab, 17 Ref.

Descriptors: *Cladophora, *Productivity, *Biomass, Bermuda, Chlorophyta, Primary productivity, Growth rates, Tracers, Analytical techniques, Benthic flora, Light, Light intensity, Nutrients, Seasonal, Invasion, Competition, Adaptation, Environmental effects.

Two possible factors explain the rapid spread of Cladophora in Bermuda as measured in a June 1977 study: (1) human activities could elevate nutrient levels; (2) C. prolifera could be an introduced species with adaptations enabling it to outcompete native species. C. prolifera productivity averages 0.567 mg C/gdw/h; average increase in wet weight/d is 1.8% increase/d. Plant productivity covered with a single Cladophora layer is reduced 90%. Productivity is higher at greater depths in June than previous measurements in December, 1976 due to greater light intensity. Productivity also sharply decreases with depth below nine m both year times, correlating light intensity and productivity. Both neutral response and decrease in productivity are observed in algae incubated with mat water. No effects are observed with ammonia or phosphate additions; this is explained by differences in plant reaction 'lag time' to different nutrients or by stored N and P. Productivity is measured by C-14 uptake, growth, and biomass accumulation. C-14 measurements show 3.1 gC/sq/m/d as mean production rate; in-situ increases show 2.7 gC/sq/m/d estimates. Mean C. prolifera biomass in June 1977 is 1838 gdw/sq/m, in December 1976 is 1495 gdw/sq/m, making productivity rates 0.7 gC/sq/m/d. Since mean daily production rates are 3.1 gC/sq/m/d, remaining plant material is either removed physically by storm activity, decomposed, or lost by grazing. (Danovich-Wisconsin)
W80-01110

PHYSIOLOGICAL ECOLOGY OF ASCOPHYLLUM NODOSUM (L.) LE JOLIS AND ITS DETACHED ECAD SCORPIOIDES (HORNEMANN) HAUCK (FUCALES, PHAEOPHYTA),
New Hampshire Univ., Durham. Dept. of Botany.
J. S. Chock, and A. C. Mathieson.
Botanica Marina, Vol 22, No 1, p 21-26, 1979. 4 Fig, 24 Ref.

Descriptors: *Plant physiology, *Light intensity, *Water temperature, *Phaeophyta, *Salinity, Photosynthesis, Light, Temperature, Algae, New Hampshire, Kelps, Ecology, Plant growth, Metabolism, Energy conversion.

The fucoid brown alga Ascophyllum nodosum and its detached ecad scorpioides both tolerate a wide variety of light, temperature, and salinity regimes according to a summer 1974-winter 1975 New Hampshire study. Net photosynthetic rates for Ascophyllum nodosum and its detached ecad scorpioides were recorded using manometric techniques; specimens were collected from Adams Point, New Hampshire. No major physiological differences were evident between the two plants. Both exhibit pronounced seasonal differences in temperature and light responses, with winter plants producing oxygen at a lower rate (26 micro 1/O2/gDw/min at 1000 ft-c) than summer plants (54 micro 1/O2/gDw/min at 1000 ft-c). Both also exhibit a eurythermal response to temperature, with optimum stronger during summer than winter. Winter specimens show a net photosynthetic plateau between 10 to 25 C, versus a conspicuous summer maximum of 18 to 21 C. Optimal light intensity is 206 microeinsteins (850 ft-c) with no seasonal optima differences; plants exhibit broad tolerance to high light intensities. Both A. nodosum and ecad scorpioides exhibit net photosynthesis decreases at intermediate salinities (18%) as compared to higher and lower salinities (40 or 0%). (Danovich-Wisconsin)
W80-01111

EFFECTS OF HIGH AND LOW ULTRAVIOLET FLUENCES ON THE FILAMENTOUS BLUE-GREEN ALGA ANABAENA L-31,
Bhabha Atomic Research Centre, Bombay (India). Biology and Agriculture Div.
T. Fernandes, and J. Thomas.
Environmental and Experimental Botany, Vol 18, No 4, p 229-239, December 1978. 7 Fig, 3 Tab, 39 Ref.

Descriptors: *Cyanophyta, *Ultraviolet radiation, *Photoactivation, Anabaena, Curves, Mortality, Plant physiology, Evolution, Adaptation, Biochemistry, Radiation, Algae, Light, Light intensity, Plant morphology, Cytological studies, Plant growth, Metabolism, Growth stages, Nitrogen fixation.

Morphological pecularities such as giant cell formation, filament cell misalignment, Y-shaped branches, three-pored heterocysts, cross-shaped branches, and loop formations indicate UV-induced inhibition of cell division and disturbances in biochemical differentiation mechanisms. Induction of true branching is significant in the evolution of algae belonging to the Stigonematales. The nitrogen-fixing capacity of certain filamentous blue-green algae has aroused great interest in the biology of these organisms. Differentiated cells, termed heterocysts, have been identified as the sites of nitrogen-fixation. Vegetative cells of Anabaena L-31 are much more sensitive to UV high and low fluences than Anabaena doliolum and Fischerella muscicola, the LD50 fluence being only 180 J/sq m compared with LD fluences of 300J/sq m and 2000 J/sq m respectively. The survival curve of Anabaena L-31 is unusual, having a broad shoulder, a narrow region of exponential kill, and a long tail. The quantitative and qualitative similarity of survival curves of Anabaena L-31 growing in nitrogen-fixing and non-nitrogen fixing conditions suggests that the nitrogenase enzyme system is not easily affected by UV. True photoreactivation was observed in heterocyst-forming Anabaena L-31 exposed to white light after UV radiation. (Danovich-Wisconsin)
W80-01112

NITRATE UPTAKE BY ENTEROMORPHA SPP. (CHLOROPHYCEAE): APPLICATIONS TO AQUACULTURE SYSTEMS,
Rhode Island Univ., Kingston. Dept. of Botany.
M. M. Harlin.
Aquaculture, Vol 15, No 4, p 373-376, December 1978. 3 Tab, 9 Ref.

Descriptors: *Nitrates, *Chlorophyta, *Nutrient kinetics, *Aquiculture, Inorganic compounds, Nitrogen, Nutrient removal, Enteromorpha, Algae, Laboratory tests, Nutrient requirements, Deficient elements.

Enteromorpha linza and E. intestinalis removed nitrates from a sea water test medium at rates considerably higher than those measured for other seaweeds. At 15 C these algae showed a V-max of 129 micro mol/h/g dry weight and a Ks of 17 micro M. At similar temperature and irradiance, Vmax and Ks for nitrates in Enteromorpha species are twice that of Codium fragile. In aquaculture systems where the objective is to strip nitrates from sea water, nitrate-rich water may be pulsed through tanks of Enteromorpha species during the day. Night feeding of Chondrus crispus culture tanks would capitalize upon the difference in nitrate uptake strategies between these two algae minimizing uptake by the Enteromorpha. This paper investigates three parameters that regulate nitrate uptake for Enteromorpha linza and E. intestinalis: temperature, lights, and substrate concentrations. At five C nitrate uptake was 19% of that measured at 15 C and at 0 C nitrate uptake was not detected. In darkness, nitrate uptake was reduced 35% in the first hour, 10% in the second hour. After standing in nitrate-depleted sea water, algae scavenged nitrate at concentrations 0.5 micro M and no nitrate leaked from the tissue into nitrate-free water. Nitrate uptake increased with increasing substrate concentrations. (Danovich-Wisconsin)
W80-01113

NUTRITIONAL EFFECT OF EIGHT SPECIES OF MARINE PHYTOPLANKTON ON POPULATION GROWTH OF THE ROTIFER, BRACHIONUS PLICATILIS,
Chlorella Co., Ltd., Toyoda (Japan).
K. Hirayama, K. Takagi, and H. Kimura.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 1, p 11-16, January 1979. 3 Fig, 3 Tab, 9 Ref.

Descriptors: *Nutrient requirements, *Phytoplankton, *Rotifers, *Laboratory tests, Population, Food chains, Productivity, Chlorella, Feeding rates, Plankton, Zooplankton, Growth rates, Microorganisms, Chlamydomonas, Fecundity.

Two species of Synechococcus elongatus and Chlorella sp were evaluated as excellent food plankton, four species of Chlamydomonas sp, Monochrysis lutheri, Dunaliella tertiolecta and Cyclotella cryptica as average, and two species of Eutroptiella sp and Nitzschia clostelium as deficient in nutritional effect on rotifers under sterile laboratory conditions. The rotifer Brachionus plicatilis is one of the important food organisms for mass cultivation of fish larvae as well as planktonic crustaceans. Nutritional effects of eight marine phytoplankton species on rotifers were investigated by feeding a single species to rotifers under axenic culture conditions. First-laid eggs of amictic rotifers were divided into two groups, one cultured with a marine phytoplankton species, the other with Chlorella sp as control in a modified Erdschreiber medium. For the Chlorella sp the cell concentrations were 1,500,000 cells/ml. Cell concentrations of the other phytoplankton species varied according to the highest value of indicies, the most desirable cell concentration. In evaluating phytoplankton nutritional effects, the intrinsic population

growth rate (r) and net production rate (Ro) were calculated from daily observations of survival rate and fecundity of many individual rotifers. Results were classified into three categories where relative r and Ro values for eight phytoplankton species were compared to those for the marine Chlorella: excellent (r or = 0.7, Ro or = 0.6), average (0.4 or = r 0.7, 0.3 or = Ro 0.6) and deficient (0.4 r, 0.3 Ro). (Danovich-Wisconsin)
W80-01114

NOTES ON THE PLANKTONIC ROTIFERS OF LAKE ONTARIO,
A. Nauwerck.
Archiv fur Hydrobiologie, Vol 84, No 3, p 269-301, November 1978. 9 Fig, 5 Tab, 24 Ref.

Descriptors: *Physiological ecology, *Speciation, *Rotifers, *Biomass, *Distribution, *Lake Ontario, Heterogeneity, Variability, Zooplankton, Great Lakes, Secondary productivity, Population, Ecological distribution, Seasonal, Systematics, Cycles, Animal behavior.

Rotifer composition, abundance, and morphometrical properties were studied in quantitative net samples collected from Lake Ontario, during 1970. Polyarthra vulgaris, Keratella cochlearis cochlearis, Synchaeta lackowitziana, and Keratella earlinae dominate among 47 identified taxa. Synchaeta, Notholca, and Kellicottia dominate in winter; in summer, Keratella, and in autumn, Polyarthra are most important species. Diversity is highest in early summer and is high again in late fall. Keratella irregularis is new for North America. Keratella hispida, considered extremely rare in North America, is common in Lake Ontario. Keratella cochlearis temporal form variability is considerable, displaying seasonal Lauterborn cycles. Low rotifers numbers are present during winter and spring. During June and July, population increases and reaches 220 ind/l maximum. In August, numbers sharply decline, followed by a second peak in September. Thereafter, numbers decrease again to winter levels in November. From east to west, rotifer abundance increases. Comparing Lake Ontario rotifers with those in other Great Lakes shows differences due to environmental conditions and zoogeographic distribution patterns. Rotifer biomass occasionally equals crustacean biomass, making rotifers an important secondary producer. An oekogram displays important rotifer genera and different Kertella species relationships with respect to temperature and food conditions. (Danovich-Wisconsin)
W80-01115

ALPINE LAKES IN KINGS CANYON NATIONAL PARK, CALIFORNIA BASELINE CONDITIONS AND POSSIBLE EFFECTS OF VISITOR USE,
California Univ., Berkeley. Dept. of Forestry and Conservation.
G. Silverman, and D. C. Erman.
Journal of Environmental Management, Vol 8, No 1, p 73-87, 1979. 7 Fig, 3 Tab, 28 Ref.

Descriptors: *Water quality, *Limnology, *Kings Canyon National Park(CA), *Environmental effects, *Mountain lakes, *Recreation demand, Land use, Lakes, Water chemistry, Phytoplankton, Recreation, Alpine, Rainfall, Oligotrophy, Sierra Nevada Mountains, Camping, National parks, Bacteria, Plankton, Periphyton, Water supply.

Although current visitor use levels and restrictions appear adequate to protect lake quality in Kings Canyon National Park, California, the lakes remain extremely vulnerable to increased recreational demand. This summer 1975 study concentrates on two oligotrophic lake basins in the southern Sierra Nevada Mountain range: Rae Lakes, a popular undeveloped backcountry area, and Sixty Lakes, adjacent to Rae Lakes and at a similar elevation (3100 to 3400 m) but receiving considerably less visitor use. Phosphate concentrations are similar in all lakes, usually ranging 6-14 micro g/l, with highest levels in early summer. While nitrate levels in Rae Lakes remain below eight micro/g/l, levels in Sixty Lakes are 50 micro g/l in July. Human input is not the primary cause of nutrient differences because peak nitrate concentrations occur prior to substantial human use. Average net phytoplankton density varies from zero to almost a million cells/l. Phytoplankton concentration is about two orders of magnitude greater throughout the Rae Lakes than the Sixty Lakes in July. Lower secchi disc transparency also occurs at Rae Lakes than at Sixty Lakes. Both nitrate and phytoplankton differences may be caused by geologic conditions of the lake basins. However, human impact may be partially responsible for the early high plankton densities and transparency decreases. Lake water is normally safe for drinking, however after precipitation, bacteria concentration increases in both lakes. (Danovich-Wisconsin)
W80-01116

ON THE MORPHOLOGY OF SUMMER ALGAE IN NON-STRATIFIED LAKES,
Princeton Univ., NJ. Dept. of Civil Engineering.
V. Van Nguyen, and E. F. Wood.
Ecological Modelling, Vol 6, No 2, p 117-131, February 1979. 9 Fig, 16 Ref.

Descriptors: *Mathematical models, *Algae, *Eutrophication, *Lakes, Growth rates, Plant growth, Productivity, Phytoplankton, Biomass, Nutrients, Chlorophyll, Air temperature, Forecasting, Water pollution effects, Population, Equations, Stochastic processes, Light, Light intensity.

This paper develops a structural model for algae dynamics, within which is contained the elementary cusp catastrophe, and which uses a geometric approach to lake eutrophication. The state equation contains the structure of a cusp catastrophe. The model framework accounts for a smooth or abrupt growth rate. The long-term behavior of algae population, or the deterministic control parameter, is a composite of nutrient level and endogeneous respiration. The stochastic control parameter, or short-term behavior causing algae blooms and crashes, is a function of light influx and air temperature. The model notes that the collapse of algae occurs during heavy overcast weather following sudden cooling and not during hot calm periods as generally accepted. Field data for non-stratified prairie ponds tested the model and initial results show that the model is effective for predicting potential algae blooms and crashes. Quantitative and qualitative aspects of the developed model can be applied to management of lake systems. (Danovich-Wisconsin)
W80-01117

MULTIPLE REGRESSION MODELING APPROACH FOR REGIONAL WATER QUALITY MANAGEMENT,
Geological Survey, Portland, OR.
For primary bibliographic entry see Field 5A.
W80-01118

GROWTH AND COMPETITION OF THE MARINE DIATOMS PHAEODACTYLUM TRICORNUTUM AND THALASSIOSIRA PSEUDONANA. II. LIGHT LIMITATION,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
D. M. Nelson, C. F. D'Elia, and R. R. L. Guillard.
Marine Biology, Vol 50, No 4, p 313-318. 1979. 3 Fig, 1 Tab, 26 Ref. NSF GB33288, OCE76-10876.

Descriptors: *Diatoms, *Light intensity, *Competition, *Limiting factors, *Cytological studies, Phytoplankton, Laboratory tests, Aquiculture, Light, Dominant organisms, Growth rates, Habitats, Silica, Algae.

Phaeodactylum tricornutum maintains higher division rates than Thalassiosira pseudonana in laboratory culture tests characterized by either low silicic acid concentrations or low light intensities. This study was undertaken to gain further information on factors making aquiculture pond environments uniquely suitable for P. tricornutum-dominated phytoplankton development. In most cases, simply enriching nutrients with silicic acid does not produce conditions allowing T. pseudonana to maintain itself with P. tricornutum in cultures. Under both 14:10 h LD cycle and continuous light, T. pseudonana divides at higher rates than P. tricornutum at high light intensities; the reverse is true at intensities below 0.003 ly/min. In light-limited continuous cultures initially containing both species, P. tricornutum is unable to maintain itself at dilution rates greater than 0.52/day, while at dilution rates less than 0.52/day, P. tricornutum predominates. Comparisons with other mass cultured algae such as Skeletonema costatum, Chartoceros and Ditylum brightwellii, show T. pseudonana normally efficient, and P. tricorntum remarkably efficient, at maintaining cell division at low light intensity. (Danovich-Wisconsin)
W80-01119

CHLOROPHYLL PRODUCTION, IN RESPONSE TO NUTRIENT ADDITIONS, BY THE ALGAE IN LAKE ROTORUA WATER,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
E. White, and G. W. Payne.
New Zealand Journal of Marine and Freshwater Research Vol 12, No 2, p 131-138, June 1978. 1 Fig, 9 Tab, 10 Ref.

Descriptors: *Chlorophyll, *Nitrogen, *Phosphorus, *Limiting factors, *Nutrient requirements, Lakes, Phytoplankton, Chemical analysis, Regression analysis, Laboratory tests, Phosphates, Nutrient loading, Algae, Eutrophication, Nutrients, Primary productivity, Lake Rotorua, New Zealand.

Chlorophyll production consistently increased along with added nitrogen in Lake Rotorua, New Zealand, but responses to additions of phosphorus and trace elements were minor by comparison; indicating a persistent shortage of nitrogen in the shallow eutrophic lake which has mean depth of 10.5 m and area of 81 sq km. A secondary sewage treatment plant began operations in 1973. Nutrient load input quadrupled from the 1960's to the 1970's. Tertiary treatment is being considered; however, the nutrients which limit lake plant growth must be determined in order to decide which tertiary method can strip the wastewater of the key nutrients. Batch cultures of both algae and water from Lake Rotorua surface waters and incoming streams were subjected to nitrogen, phosporus, and trace element additions, singularly and in combinations, at monthly intervals June 1975 to May 1976. Algal lakewater chlorophyll production from inorganic nitrogen alone was double the normal amount expected from reactive phosphorus concentrations. The nitrogen-to-phosphorus requirements would have been 40:1 to bring the predicted chlorophyll response to the observed value. A source of phosphorus other than the measured reactive amount was available to the phytoplankton. However, both phosphorus and the proven nitrogen are important nutrients in Lake Rotorua because a wide range of nitrogen-to-phosphorus ratios (4-35:1) increased chlorophyll production in stream water which flows into the lake. (Danovich-Wisconsin)
W80-01120

TROPHIC STATUS OF TWENTY-ONE NEW ZEALAND HIGH COUNTRY LAKES,
Cawthron Inst., Nelson, New Zealand.
M. J. Spencer.
New Zealand Journal of Marine and Freshwater Research, Vol 12, No 2, p 139-151, June 1978. 4 Fig, 4 Tab, 23 Ref.

Descriptors: *Lakes, *Water quality, *Trophic levels, *Oligotrophy, *Mesotrophy, *Lake stages, *Analytical techniques, New Zealand, Chemcical analysis, Eutrophication, Nitrogen, Phosphorus, Chlorophyll, Aquatic productivity, Dystrophy, Limnology, Nutrient loading, Bacteria.

Waters of high country lakes of South Island, New Zealand are generally of high biochemical quality However, recent studies indicate some lakes have changed algal composition and nutrient loading The main objective of this December 1975-March 1976 study was to obtain chemical and microbiological data on 21 lakes in three major river watersheds to establish relative trophic status. Lake size ranges from Lake Coleridge with 3290 ha and 200 m maximum depth to Lake Vagabond's Inn of 1.6

ha and 0.8 m maximum depth. Measurements were taken of the heterotrophic potential (v-max), or maximum rate of substrate uptake by heterotrophic microorganisms, bacteria, ATP, chlorophyll, pH, alkalinity, dissolved CO2, nitrogen compounds, total and soluble phosphorus, calcium, magnesium, and chloride. V-max is a good indicator of trophic levels because it correlates well with bacterial counts, soluble carbon, particulate carbon, and particulate nitrogen concentrations and is more sensitive than BOD measurements for discerning water quality effects of nutrient enrichments. The two largest deepest lakes have an average v-max of 0.002 micro g/l/hr indicating high oligotrophy. The trophic level of one lake was intermediate. The eight other oligotrophic lakes had an average area of 98 ha, maximum depth range of 10-40 m, and an average v-max of 0.017 micro g/l/hr. The five mesotrophic lakes had an average v-max of 0.031 micro g/l/hr and the five shallower mesotrophic lakes had an average v-max of 0.071 micro g/l/hr. (Danovich-Wisconsin)
W80-01121

NUTRIENT CYCLING AND PRIMARY PRODUCTION IN PORT HACKING, NEW SOUTH WALES,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
B. D. Scott.
Australian Journal of Marine and Freshwater Research, Vol 29, No 6, p 803-815, 1978. 6 Fig, 18 Ref.

Descriptors: *Cycling nutrients, *Oxygenation, *Primary productivity, *Thermal stratification, *Port Hacking Estuary, Australia, *Estuaries, Nutrients, Nitrates, Australia, Oxygen, Temperature, Water temperature, Phosphates, Silicates, Salinity, Stratification productivity, Regression analysis, Tidal effects, Density, Estuarine environments.

Oxygen consumption and nutrient regeneration in lower water columns of South West Arm in Port Hacking, Australia, correlates to density differences in the lower water column and to primary production. This 1975 investigation of Port Hacking estuary examines temperature and salinity stratification in relation to primary production and dissolved oxygen, silicate, phosphate, and nitrate concentrations. Both temperature and salinity stratification periods are accompanied by deoxygeneration below 10 m. Apparent oxygen utilization (AOU) correlates to density differences below tidal exchange levels. Recent biodetritus originating from primary production causes deoxygenation; this is evident from relationships between AOU in the lower water column in stratification and deoxygenation periods. Silicate regeneration correlates to AOU with slight seasonal changes; during September to February, regenerated silicate to AOU ratio decreases, indicating small diatom propor tion to phytoplankton. Phosphate regeneration correlates to AOU. Nitrate regneration correlates to AOU. Nitrate regeneration correlates to AOU during salinity stratification but not temperature stratification. Deoxygenation rates and ratios of regenerated phosphate to AOU are greater after heavy rainfall. Nutrient release from the lower water column by destratification and mixing is accompanied by high primary production. During these times, the phosophate used in photosynthesis is 10 times phosphate amounts released by mixing, indicating phosphate recycling in the euphotic zone. (Danovich-Wisconsin)
W80-01122

VEGETATION AND NUTRIENT STATUS OF NORTHERN MICHIGAN FENS,
Michigan Univ., Pellston. Biological Station.
C. R. Schwintzer.
Canadian Journal of Botany, Vol 56, No 24, p 3044-3051, 1978. 2 Tab, 26 Ref.

Descriptors: *Fens, *Systematics, *Plants, *Biological communities, Michigan, Vascular tissue, Vegetation, Wetlands, Bogs, Peat, Water chemistry, Marsh plants, Ecosystems, Ecological distribution, Nutrients, Saturated soils, Water table.

Carex lasiocarpa is the most prevalent dominant plant and vegetation is relatively homogeneous in five fens in Cheboygan and Emmet Counties in northern Lower Michigan. This 1977 study examined fen vegetation and water characteristics to determine prevalent and dominant vegetation species, range of water chemistry conditions, and Juglum classification and nomenclature. The field layer dominates the vegetation stratum in all five fens while tree and shrub layers are absent or sparse. The field layer contains 85 vascular species with 30 vascular species/stand mean density. Other common dominants in decreasing importance are Carex aquatilis, Myrica gale, and Andromeda glaucophylla. Common subordinates are Hypericum virginicum, Muhlenbergia glomerata, and Campanula aparinoides. Homogeneity index is 58%. Mean depth to water from soil surface varies 10 to 72 cm. Shallow groundwaters are minerotrophic with pH values ranging from 5.7 to 7.0, and 11.0 to 75.0 mg/l calcium concentrations. Four fens are on floating mats with relatively stable water levels while the fifth is a grounded mat with substantial water level fluctuations from above ground to 72 cm below the surface. Consistent relationships between minerotrophic waters and fen vegetation occurs in nine separate Michigan peatlands. (Danovich-Wisconsin)
W80-01123

EXPERIMENTAL STUDIES ON FACTORS LIMITING COLONIZATION BY DAPHNIA PULEX LEYDIG OF COASTAL MONTANE LAKES IN BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Inst. of Animal Resource Ecology.
W. E. Neill.
Canadian Journal of Zoology, Vol 56, No 12, p 2498-2507, 1978. 4 Fig, 5 Tab, 24 Ref.

Descriptors: *Limiting factors, *Food abundance, *Daphnia, *Ecological distribution, Zooplankton, Distribution, Lakes, Canada, British Columbia, Biological communities, Water quality, Predation, Invasion, Nutrients, Productivity, Mountains, Mountain forests, Aquatic environment.

Combined effects of water quality, food levies, and CHaoborus predation makes Daphnia pulex a marginal species in coastal montane lakes in British Columbia as compared to its abundant productivity in other North American lakes. Relatively small changes in food resource abundance or predator levels indicates D. Pulex colonization success or failure. Laboratory and field experiments were conducted in summer periods 1974-1975; factors including water quality, food supply, and predation by larval phantom midges upon species growth, survival and reproduction were examined. Montane lakes are generally small, nutrient poor, well-stratified in summer, oxygen rich, and deep. D. pulex juveniles reared in water from one typical lake survived but did not grow as well as those in coastal pond waters, even with comparable food abundances. Water quality, such as inorganic ions leaching from surrounding coniferous forests, is implicated. Both laboratory experiments and large-scale fertilizer manipulations in situ prove that D. pulex population growth is limited by scarce food resources. Reproduction, as well as juvenile growth and survival, are highly influenced by food concentrations. Daphnia rosea is a chief competitor in field experiments, contributing 75% of summertime seston grazing pressure. D. rosea juveniles deal with food limitations better than D. pulex juveniles. In laboratory experiments, CHaoborus trivittatus is a significant predator; however, modest fertilization levels enables D. pulex to outstrip predator abilities. (Danovich-Wisconsin)
W80-01124

SEASONAL CHANGES IN PHYTOPLANKTON DENSITIES IN FOUR NORTH ISLAND LAKES, 1973-74,
Department of Scientific and Industrial Research, Auckland (New Zealand). Botany Div.
V. Cassie.
New Zealand Journal of Marine and Freshwater Research, Vol 12, No 2, p 153-166, June 1978. 3 Fig, 4 Tab, 43 Ref.

Descriptors: *Phytoplankton, *Cyanophyta, *Dominant organisms, *Eutrophication, *Indicators, *Algal blooms, *Algae, Rotorua District, New Zealand, Lakes, Seasonal, Fluctuations, Water quality, Plankton, Aquatic algae, Aquatic productivity, Trophic level.

This June 1973-May 1974 New Zealand study examined preserved material from phytoplankton populations from four lakes in the Rotorua District of North Island, New Zealand and used it to determine trophic levels. Each lake has its own distinctive species combinations and dominance patterns. Surface dominant diatoms and subsurface dominants are quite different. Dominance is considered in conjunction with species, quantity, and volume of cells present. Lake Rotoehu experienced a February bloom of Aphanizomenon flos-aquae, a blue-green alga toxic to cattle and fish. Osillatoria limosa, an alga indicative of polluted water, and Anabaena were also present. In April, dense blooms of Rhizosolenia eriensis and Melosira granulata occurred, while Eudorina dominated in November. Dinobryon and Ceratium phytoplankton dominated Lake Rotoma; Melosira granulata was the dominant species in March and April. Anabaena aphanizomenoides displayed minor dominance in February. In Lake Roiti, Melosira dominated in the winter; Dinobryon dominated in the summer. Lake Waikeremoana experienced Staurastrum dominance in the summer, while Ceratium, Asternionella, and Botryococcus prevailed in the autumn and winter. Trophic levels were determined on the basis of the compound index. Lake Rotoehu is in an advanced stage of eutrophication, Lake Rotoma is slightly eutrophic, and Lakes Roiti, and Waikaremoana are still oligotrophic. (Danovich-Wisconsin)
W80-01125

THE ANALYSIS OF NITROGEN FORMS IN WATERS AND WASTEWATERS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
D. Jenkins.
Progress in Water Technology, Vol 8, No 4-5, p 31-53, 1977. 4 Fig, 11 Tab, 51 Ref.

Descriptors: *Nitrogen, *Literature survey, *Chemical analysis, *Laboratory tests, *Analytical techniques, Waste water, Ammonia, Distillation, Inorganic compounds, Reduction(Chemical), Testing procedures, Quality control, Organic compounds, Nitrites, Nitrates, Colorimetry, Digestion, Spectrophotometry, Polarographic analysis.

Current analytical methodologies for determining total, organic, ammonia, nitrite, and nitrate nitrogen is reviewed. The Kjeldhl digestion method is used to compute total nitrogen. The greatest problem occurs in low values less than 200 micro g/l. A blank value is caused by sulfuric acid in the digestion mixture. The amount of organic nitrogen equals the difference between total nitrogen and an ammonia determination. Ammonia nitrogen methods include protonated ammonium ion or aqueous ammonia wet chemical analyses. Satisfactory methods are available for various concentrations of ammonia ranging from 50 micro g/l to 30 mg/l. A borate buffer is recommended for the ammonia distillation process. Measurements from nitrite from one micro g/l to two mg/l do not present analytical difficulties from either a sensitivity of interference viewpoint. Techniques used are diazotization followed by coupling of the azo-compound at low pH. Nitrate determinations are the most difficult and have the greatest number of interferences. UV spectrometry, polarography, specific ion electrodes, and colorimetric methods are used. The latter method has disadvantages in performance, convenience of conduct, or interferences with nitrate in the 0.1-10 mg/l range. Excellent methods exist for analyzing very high nitrate levels, greater than five mg/l, and for very low nitrate levels, less than 0.5 - 1 mg/l in both fresh and saline waters, however, a technological gap exists for analyzing intermediate levels. (Danovich-Wisconsin)
W80-01127

NITROGEN IN ORGANIC MATTER AND FERTILIZER AS A SOURCE OF POLLUTION,

Institute for Soil Fertility, Groningen (Netherlands).
G. J. Kolenbrander.
Progress in Water Technology, Vol 8, No 4-5, p 67-84, 1977. 8 Fig, 4 Tab, 57 Ref.

Descriptors: *Nitrogen, *Water pollution sources, *Fertilizers, *Manure, *Organic wastes, *Leaching, Literature survey, Farm wastes, Volatility, Legumes, Seepage, Organic compounds, Crop production, Nitrification, Denitrification, Nitrogen cycle, Leachage, Nitrates, Drainage, Soils.

Replacing organic nitrogen sources partially by mineral fertilizer nitrogen will reduce losses by leaching and denitrification. Limiting nitrogen fertilizer consumption reduces nitrogen losses but also reduces crop production. Denitrification takes place mainly in the rooting zone and conditions for denitrification are more favorable with increasing soil heaviness, which reduces water percolation velocity and promotes anaerobic conditions after rainfall in the upper soil layers. There is normally enough energy for denitrification to occur. On light sandy soils, nitrogen leaching increases with increasing organic nitrogen inputs. At least 50% of the fertilizer applied is recycled into organic nitrogen by way of green manure, plant residues, and animal and human products. Dilution is the most important process in managing ground water quality. World use of nitrogen fertilizers to enhance crop production has been increasing. But fertilizers are serious pollutants to surface waters, causing eutrophication in lakes, and to ground water supplies, posing health hazards to humans and livestock. This paper also addresses two environmental concerns: how much nitrate losses by leaching from the rooting zone can be reduced, and the volatization energy needed in subsoil for the biological reduction of nitrates which has been washed out of the rooting zone. Nitrogen availability to crops nitrogen losses by leaching, volatization, and crop removal, and nitrogen losses in the subsoil by seepage and denitrification are also examined. (Danovich-Wisconsin)
W80-01128

MICROBIAL TRANSFORMATIONS OF INORGANIC NITROGEN,

Water Pollution Research Lab., Stevenage (England).
H. A. Painter.
Progress in Water Technology, Vol 8, No 4-5, p 3-29, 1977. 1 Fig, 155 Ref.

Descriptors: *Nitrogen, *Inorganic compounds, *Microbiology, *Nitrogen cycle, *Nitrogen fixing bacteria, *Nutrient kinetics, *Cycling nutrients, Microorganisms, Literature survey, Nitrogen fixation, Ammonia, Biochemistry, Anaerobic bacteria, Aerobic bacteria, Cyanophyta, Dissolved oxygen, Denitrification, Nitrification, Sewage treatment, Azotobacter.

To establish which nitrogen transformations are occurring and their extent, or to achieve a nitrogen balance, isolation and enumeration of relevant organisms must be augmented with determinations of concentrations and changes in amounts of the particular chemical species of nitrogen. This literature survey reviews nitrogen transformations in natural waters and their importance in waste water treatment. Three main microbiological processes involve inorganic nitrogen: assimilation, dissimilation, and nitrification. Conversion of inorganic nitrogen to cellular components such as proteins and nucleic acids takes place in all plants and microorganisms. Inorganic nitrogen makes use of the oxygen bound in compounds for respiration and it is involved with oxidation of compounds to provide energy for synthetic reactions. These processes can affect the aqueous environment by ammonia toxicity to fish, oxygen depletion by nitrification, and assimilation of nitrogen by algae causing eutrophication. Present physical-chemical methods of sewage treatment are much less efficient in removing inorganic nitrogen than are the biological processes. The most economically important reaction is autroptrophic nitrification. However, the nitrification rate in treatment processes is about half that in pure cultures. Considering biochemical processes, nitrogen removal from waste waters can be achieved by either a completely separate, anaerobic stage for denitrification or an alternating aerobic-anaerobic mixed system. (Danovich-Wisconsin)
W80-01129

THE INFLUENCE OF NITROGEN FERTILIZERS ON STREAM NITRATE CONCENTRATIONS NEAR ALLISTON, ONTARIO, CANADA,

York Univ., Downsview (Ontario). Dept. of Geography.
A. R. Hill, and N. Wylie.
Progress in Water Technology, Vol 8, No 4-5, p 91-100, 1977. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Fertilizers, *Nitrates, *Streams, *Water pollution sources, *Non-point sources, Canada, Lotic environment, Nitrogen, Groundwater, Agriculture, Farm wastes, Running wastes, Flow, Precipitation(Atmospheric), Surface runoff, Drainage, Farms.

Although fertilizers have been applied extensively in the Alliston area, Simcoe County, Ontario, 1974 stream water samples show little evidence of significant fertilizer contribution to stream nitrate levels. High nitrate concentrations were observed in the tile drain discharge and in groundwater underlying heavily fertilized potato fields. Adjacent rivers generally show low nitrate levels, except during major rises in discharge, when nitrate concentrations increase in response to surface runoff from 0.46 mg/l to two mg/l and tile drain discharge up to 25 mg/l. Fertilizer consumption in the past 20 years has been increasing rapidly and was therefore thought responsible for the rising nitrogen levels in water bodies thus contributing to the eutrophication problem. On a glacial sand plain, eight separate fields adjacent to the main regional streams were studied. Stream water samples at 48 sites were collected weekly during 1974, April 21-August 31, then every three weeks September-December. Nitrate nitrogen concentrations were measured by auto-analyzer; total nitrate and nitrate were determined by copper-cadmium reduction of nitrate to nitrite. Difficulties of evaluating the contribution of fertilizers to water pollution are noted, with the suggestion that such research should in the future be based on detailed sampling over a number of years. (Danovich-Wisconsin)
W80-01130

COMPARISON OF KINETIC MODELS FOR THE SIMULATION OF ALGAL GROWTH,

Ghent Rijksuniversiteit (Belgium). Inorganic Chemistry Lab.
E. Van Vaerenbergh, and H. Paelinck.
In: Modeling, Identification and Control in Environmental Systems, p 635-647, 1978. 2 Fig, 4 Tab, 11 Ref. IFIP, North-Holland Publishing Company.

Descriptors: *Plant growth, *Algae, *Artificial substrates, *Mathematical models, Plant growth substances, Kinetics, Substrates, Simulation analysis, Metabolism, Nitrates, Inhibition, Growth rates, Nutrients, Regression analysis, Orthophosphate, Phosphates.

Steady-state points of turbidostatically controlled semi-discontinuous algal cultures could not be treated as steady-state points of continuous cultures, therefore necessitating simulation of the culturing procedure. Biological processes have been widely applied recently. Algae have been used to study primary production, water purification, eutrophication and algal blooms. In order to best use algal culture, knowledge and understanding of nutrient metabolism and concordant mathematical models are needed. The regression for single limitations as steady-state points of continuous cultures give reliable parameter values for growth, but inaccurate values for nutrient uptake. For phosphage nutrition, there is strong noncompetitive inhibition of growth due to uptake. Nitrate nutrition also reveals a substrate inhibition for uptake. This leads to a conclusion that the energy requirement is less for the uptake of nitrates than of phosphates. A linear relationship occurs between the residual and feed medium concentration. Nitrate experiments had a slope with a value of one in simulating the steady state points. The phosphate experiments had a slope of 0.66, indicating that an unknown reaction was transforming and consuming the medium orthophosphate. The limits of the Nutrient-content of continuously cultured Scenedesmus were calculated at 11.79-2.26% for N and 3.890.24 for P (Danovich-Wisconsin)
W80-01131

A DYNAMIC MODEL OF QUALITY OF RIVER WATER WITH CONSIDERATION OF NITRIFICATION PROCESS,

Kyoto Univ. (Japan). Dept. of Applied Mathematics and Physics.
M. Shima, F. Delebecque, and N. Adachi.
In: Modeling, Identification and Control in Environmental Systems, p 511-526, 1978. 9 Fig, 10 Ref. IFIP, North-Holland Publishing Company.

Descriptors: *Mathematical models, *Rivers, *Nitrification, *Equations, *Self-purification, *Oxygen sag, Water quality, Microorganisms, Nutrient cycling, Simulation analysis, Oxygen demand, Reaeration, Lotic environment, Water pollution, Dissolved oxygen, Model studies.

Mathematical models and simulations are used to analyze self-purification processes in rivers. A second sag in the dissolved oxygen (DO) curve occurs for a wide range of parameter values in these processes. The nitrification-linked depth and duration of the low DO concentrations sag are mainly dependent on initial ammonium quantity, initial organic load discharged, maximum specific growth rate of Nitrobacteria, growth limiting factors, concentrations of DO and ammonium. Dynamics of nitrification and its effects on water quality are clarified and the biodegradation of organic material, nitrification, and reaeration processes are included. A dynamic model is constructed according to a modified monod model of microbiological reactions. The model is not intended for direct application to a real river but points out that the nitrification process is an essential element for any practical model simulating an actual long river. For example, this model helps explain extremely low Do concentrations seen at the lower reaches of the Seine River in France. The model also agrees with qualitative experimental results of Edeline and Lambert on river self-purification processes. This model exposes deficiencies of the Streeter-Phelps model, which assumes a first order reaction for the biodegradation of BOD and neglects the nitrification process. (Danovich-Wisconsin)
W80-01132

MODELS FOR PREDICTING WATER POLLUTION FROM AGRICULTURAL WATERSHEDS,

Science and Education Administration, Chickasha, OK. Southern Great Plains Watershed Research Center.
M. H. Frere.
In: Modeling, Identification, and Control in Environmental Systems, p 501-509, 1978. 17 Ref. IFIP, North-Holland Publishing Company

Descriptors: *Agricultural watersheds, *Water pollution, *Mathematical models, *Model studies, Sediments, Salinity, Nutrients, Pesticides, Water pollution control, Water pollution sources, Runoff, Hydrologic data, Planning, Simulation analysis, Water quality, Watersheds(Basins), Hydrology.

Modelling as applied to agriculture-derived water pollutants attempts to describe water quality at some future time under specified conditions; this paper reviews current techniques. An agricultural chemical transport model was developed to predict concentrations and amounts of nutrients, pesticides, and sediments lost from farm-sized watersheds. It combines the USDA hydrographic laboratory model for simulating hydrology, the Onstad-Foster model for erosion, and the Frer model for chemical transport. A hydrology model has been calibrated and tested on watersheds ranging from 9.1-40.7 sq km in size in four states. An agricultural runoff model includes subprograms in hydrology and is equivalent to the Stanford watershed model. Hydrology, sediment, and pesticide subprograms have been tested; and the greatest

deficiency is that tilling operations, which affect runoff and sediment loss, have not been included in the model. A nonpoint source pollutant loading model can handle larger areas with mixed land uses. The model was calibrated with data from three metropolitan area watersheds. A simplified planning hydrologic model is based on the curve number model (U.S. SCS) and the Universal Soil Loss Equation. It is used to predict overland flow and simulate the amount of soil and chemical loss by the input of weather records. (Danovich-Wisconsin)
W80-01133

EUTROPHICATION MODELS,
Royal Danish School of Pharmacy, Copenhagen. Dept. of Chemistry.
S. E. Jorgensen.
In: Modeling, Identification and Control in Environmental Systems, p 473-500, 1978. 3 Fig, 16 Tab, 56 Ref. IFIP, North-Holland Publishing Company.

Descriptors: *Mathematical models, *Equations, *Model studies, *Eutrophication, Light, Lakes, Regression analysis, Zooplankton, Phytoplankton, Nitrogen cycle, Ecosystems, Temperature.

Stating goals is the first part of a strategy for setting up an ecological model to solve a specific eutrophication problem. The processes and state variables are obtained by listing relevant mass-flows and calculating system energy. After state variables are selected, a system dynamics flow diagram and the equations are set up. Next a sensitivity analysis is carried out, followed by model calibration using a set of observations from one or more ecosystems. Automatic calibration, which changes parameter values in response to the sensitivity analysis, is preferred. Finally, the model must be validated against an independent set of observations before it can be used as a predictive tool. The strategy of lake modeling is to build a model complex enough to give an acceptable description of the lake processes. The paper focuses on dynamic causally based models and reviews the following equations: phytosynthesis, light limiting expression, zooplankton grazing rates, settling, nitrogen fixation, denitrification, release of nutrients from the sediment, temperature effects upon biological rates, rate of exchange between epilimnion and hypolimnion, rate of exchange between water and atmosphere, detritus, and zooplankton respiration, excretion, and mortality. The symbols used in the equations, parameter values and stoichiometric ratios, all previously applied in several studies are reviewed. (Danovich-Wisconsin)
W80-01134

BENZO(A)PYRENE: STUDIES OF THE EFFECTS OF THIS UBIQUITOUS POLLUTANT ON FISHES,
University of Southern California, Los Angeles. Inst. for Marine and Coastal Studies.
H. Puffer, K. Duncan, E. Von Hofe, and D. Winkler.
In: 'Oceans '79', Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and Marine Technology Society, held San Diego, California, September 17-19, 1979. p 398-400, 3 Ref. IEEE, New York, Publication No 79 CH 1478-70EC.

Descriptors: *Industrial wastes, *Water pollution effects, *Oil pollution, Environmental effects, Sediments, Fish, Toxicity, Pollutants, *Outer Continental Shelf, Petroleum industry, Hydrocarbons, Carcinogens, Benzo(a)pyrene(BaP).

Polycyclic aromatic hydrocarbons (PAH) are recognized environmental contaminants. The source of these carcinogenic pollutants are numerous including industrial effluent, petroleum spillage which accompanies offshore drilling, domestic waste, and the runoff of asphalt roads. PAH's have been found and measured in marine bottom sediments and in marine animals. Many of these compounds, particularly benzo(a)pyrene (BaP) and its metabolites, are known to be potent chemical carcinogens. Using harbor environmental levels as a guide, the following studies were undertaken: (1) acute toxicity and chronic tumor induction, (2) BaP metabolism and distribution; and (3) effect on fecundity. (Sinha-OEIS)
W80-01137

RESPONSE TO OIL SPILLS IN THE ARCTIC ENVIRONMENT: A REVIEW,
Science Applications, Inc., Boulder, CO. Marine Environmental Science Div.
B. Morson, and E. Sobey.
In: 'Oceans '79', Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and the Marine Technology Society, held San Diego, California, September 17-19, 1979. p 407-414, 53 Ref. IEEE, New York, Publication No 79 CH 1478-70EC.

Descriptors: *Environmental effects, *Oil spills, *Cold regions, *Arctic, Sea ice, Water pollution, Resources development, Equipment, Personnel, *Outer Continental Shelf.

A review is presented of the response techniques that are applicable to oil spills in Arctic conditions, onshore and at sea. The fate of oil in these environments is briefly discussed, and resource considerations for responding to oil spills are outlined. Currently available oil spill response techniques have limited effectiveness in the Arctic because of low temperatures, the presence of ice and snow, the long periods of winter darkness, and the inaccessibility of much of the arctic environment. These environmental conditions place severe constraints on both equipment and personnel. (Sinha-OEIS)
W80-01138

ENVIRONMENTAL IMPACT ASSESSMENT FOR OPERATIONAL OTEC PLATFORMS,
Interstate Electronics Corp., Anaheim, CA. Oceanic Engineering Div.
M. D. Sands.
In: 'Oceans '79', Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and Marine Technology Society, held San Diego, California, September 17-19, 1979. p 546-547, 2 Ref. IEEE, New York, Publication No 79CH1478-7OEC.

Descriptors: *Resources development, *Energy conversion, *Environmental effects, Water pollution effects, *Outer Continental Shelf, Ocean Thermal Energy Conversion(OTEC), Environmental impact.

As the Ocean Thermal Energy Conversion (OTEC) Program advances toward commercialization, the potential environmental impacts of large scale development must be assessed. Design modifications that will mitigate or reduce potentially adverse effects must be identified and incorporated into the design configurations. In the second phase of Interstate Electronic's OTEC Environmental Impact Assessment Program sponsored by the Department of Energy, the key issues associated with the deployment and operation of demonstration and commercial size plants are under evaluation. The impacts that may occur in the marine environment include: climatological consequences (carbon dioxide release); platform attraction; ocean water mixing (nutrient and thermal redistribution); organism impingement and entrainment; biocide release; working fluid leaks; cable implantation; and metallic ion release. (Sinha-OEIS)
W80-01139

MODELING OF OIL MIGRATION IN PUGET SOUND,
Science Applications, Inc., Raleigh, NC.; and National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. Karpen, and J. Galt.
In: Oceans '79, Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and Marine Technology Society, held San Diego, California, September 17-19, 1979. p 628-634, 8 Fig, 21 Ref. IEEE, New York, Publication No 79CH 1478-7 OEC.

Descriptors: *Oil pollution, *Model studies, *Oil spills, *Dispersion, Currents, Environmental effects, Water pollution effects, Washington, Winds, Migration, *Outer continental shelf, Puget sound.

The oil migration is simulated with a mixed Lagrangian-Eulerian model. The movement of the oil is modeled with Lagrangian point masses or Lagrangian Elements (LE). Time dependent dispersion is applied to the individual LEs. Eulerian current and wind fields are used to advect the LEs. Several scenarios for hypothetical spills in the Straits and upper Puget Sound are shown. The model accurately predicted the migration of the diesel oil spill at Ancortes, Washington. The model is general enough so that submodels for currents and winds developed for other regions can be easily integrated into the simulation. (Sinha - OEIS)
W80-01140

FIELD STUDY OF POLLUTANT MIGRATION IN THE VICINITY OF A COASTAL FRONT,
Science Applications, Inc., Raleigh, NC.
E. Waddell, J. Karpen, and P. Debrule.
In: Oceans '79, Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and Marine Technology Society, held San Diego, California, September 17-19, 1979. p 635-641, 11 Fig, 9 Ref. IEEE, New York, Publication No 79 CH 1478-7 OEC.

Descriptors: *Baseline studies, *Pollution, *Migration, *Coasts, *Tidal waters, Resources development, South Carolina, Estuaries, Dispersion, *Outer Continental shelf, *Coastal fronts, *Plumes, Oil slicks.

Discharge of estuarine water onto the shelf can create plumes with limits defined by fronts. The associated density field can produce a circulation with flow toward the front and back down along a density interface. In a field study, made east of Hilton Head Island, SC, surface and dispersed pollutant simulators were released in the vicinity of such a front and tracked using aerial photographic techniques. Tracers tended to converge to the front at only a small portion (10%) of the front's migration velocity. Most fixed-frame tracer velocities resulted from tidal currents and plume growth. Wind effects caused divergence between aluminum chips and dyes. At times, wind shear moved aluminum across the front and against the convergent surface currents. When shear was weaker, luminum accumulated on a moving front. Dyes were subducted along the density interface. Within the plume, vertical mixing and resultant dispersion were probably due to stronger vertical gradients in horizontal velocity than found in the ambient velocity field. Exchange between plume and ambient water was often inhibited by the strong stable pycnocline. The long-term objective of the study is to assess the importance of such interfaces in regulating transport of pollutants, since convergence zones have been known to capture and hold oil slicks and pollutants concentrated in surface films, and to transport some of this material down into the water column. (Sinha-OEIS)
W80-01141

SOUTHERN CALIFORNIA OUTER CONTINENTAL SHELF BASELINE STUDIES: INTERCALIBRATION OF PARTICIPATING HYDROCARBON LABORATORIES,
Science Applications, Inc., La Jolla, CA. Trace Environmental Chemistry Lab.; and California Univ., Los Angeles.
J. R. Payne, P. J. Mankiewicz, J. E. Nemmers, and R. E. Fordan.
In: Oceans '79, Fifth Annual Combined Conference of Institute of Electrical and Electronics Engineers and Marine Technology Society, held San Diego, California, September 17-19, 1979. p 777-785, 1 Fig, 3 Tab, 9 Ref. IEEE, New York, Publication No 79 CH 1478-7 OEC.

Descriptors: *Baseline studies, *Laboratory tests, *Water pollution effects, *Oil pollution, California, Monitoring, Calibrations, Quality control, *Outer continental shelf, Southern california bight, Petroleum hydrocarbons, Pollution monitoring.

As part of the Bureau of Land Management's Outer Continental Shelf Baseline Program in the

Southern California Bight, a total of five different Hydrocarbon laboratories were involved in the analytical effort to measure petroleum hydrocarbons in marine samples. In this paper, the results of intra and inter-laboratory calibration exercises are presented. These data demonstrate that comparableresults can be generated by different environmental laboratories through careful adherence to established and controlled laboratory protocol and diligent efforts to intercalibrate the laboratories through varied sample exchange. Clearly, continued attention must be paid toward developing improved methodology for pollutant monitoring; however, data illustrate a significant improvement in intra and inter-laboratory precision over other OCS programs to date. (Sinha - OEIS)
W80-01142

OFFSHORE OIL: ITS IMPACT ON TEXAS COMMUNITIES. VOLUME I - EXECUTIVE SUMMARY,
Research and Planning Consultants, Inc., Austin, TX.
Research and Planning Consultants, Inc. Report to the Texas Coastal Management Program, General Land Office of Texas, June, 1977. 69 p, 3 Fig, 2 Map, Illust.

Descriptors: *Texas, *Resources development, *Environmental effects, *Coasts, Economics, Ecosystems, Oil pollution, Water pollution effects, *Outer continental shelf, Environmental effects.

The citizens of the coastal region of Texas are among those most immediately affected by oil and gas development in the Gulf of Mexico. Attempts have been made in the past to calculate the impacts of outer continental shelf development with simple formulae. However, the problem is complex. This report attempts to bridge the gap between a sophisticated computer analysis of impacts and the readily employed likely impacts. The volumes in this study provide an extensive data base. For example, the employment, land use, water use, tax revenue, government service cost, population, and other factors associated with incremental increases of OCS activities are given. So are reasonable ranges for production in the OCS, an inventory of existing facilities, a description of industry practices, and much more. Fiscal effects on impacted communities have been formulated, but the determination of social, environmental, land use, water and other impacts cannot be made so simply. This report presents a process by which such determinations can be made and that process can be used in the future as a guide to the analysis of specific OCS oil and gas activities in specific areas. (Sinha - OEIS)
W80-01143

EVIDENCE OF ARGO MERCHANT CARGO OIL IN MARINE BIOTA BY GLASS CAPILLARY GC ANALYSIS,
NOAA National Analytical Facility, Seattle, WA.
For primary bibliographic entry see Field 5A.
W80-01144

IMPACT OF THE ARGO MERCHANT OIL SPILL ON MACROBENTHIC AND PELAGIC ORGANISMS,
Food and Agriculture Organization of the United States, Rome (Italy).
W. W. Kuhnhold.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences.p153-179, 14 Fig, 3 Tab, 27 Ref.

Descriptors: *Oil spills, *Environmental effects, *Water pollution effects, Resources development, Aquatic life, Benthos, Massachusetts, *Outer continental shelf, Macrobenthos, Pelagic organisms, Argo merchant oil spill.

Abundance studies in benthic and pelagic communities including commercial fish species were done but did not suggest a major adverse impact. Zooplankton was, at some stations, fouled with oil. At some stations within the slick area and close to the margin lower densities of ichthyoplankton were found; pelagic fish eggs of the only two species present were contaminated and found moribund to a high degree. Laboratory experiments with cod eggs and young larvae were conducted with a no. 6 fuel oil to determine toxic levels of dissolved hydrocarbon concentrations. Very few of the fish examined, showed traces of Argo Merchant oil in stomach contents or muscle tissue. Prey-predator relationship seemed to have remained normal. Shortcomings in sampling methodology and evaluations are discussed. (Sinha - OEIS)
W80-01145

OIL SPILL BEHAVIOR IN ICE DURING THE 1977 BUZZARDS BAY OIL SPILL,
P. C. Deslauriers.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 198-215, 7 Fig, 2 Tab, 16 Ref

Descriptors: *Oil spills, *Ice, *Cold regions, *Water pollution effects, *Path of pollutants, Movement, Sea ice, Resources development, Environmental effects, *Outer continental shelf, Pollutant transport.

On January 28, 1977, the barge Bouchard no. 65 grounded, releasing approximately 81,150 gallons of No 2 home heating oil into Buzzards Bay, which was 90% ice covered. Field measurements and observations were initiated at the spill site on January 29, and continued until February 25, when only negligible amounts of oil remained in the bay. This paper documents these findings and puts these results in perspective with present state-of-the-art of oil spill behavior in ice-infested waters. Most of the present data on oil pollution in ice-covered waters has been obtained from spills in static ice conditions. The Buzzards Bay spill, which occurred in moving ice, therefore merited special attention. Of particular interest was the initial transport of the oil under the ice, its concentration in the rafted ice, the interaction of the oil with the hummocks and pressure ridges, its spreading from concentrated pools on the surface of ice floes, its penetration into the snow and ice, the weathering of the oil, and its final transport by ice floes during breakup. By continuing to respond with study teams to 'spills of opportunity' in cold regions, knowledge of the behavior of oil spilled in these regions can be substantially improved, and our ability to properly prepare effective countermeasures will be greatly enhanced. (Sinha - OEIS)
W80-01146

WEATHERING ESTIMATIONS FOR SPILLED OIL FROM BOUCHARD NO 65,
NOAA National Analytical Facility, Seattle, WA.
W. D. MacLeod Jr., M. Y. Uyeda, A. J. Friedman, and P. Prohaska.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 217-228, 5 Fig, 2 Tab, 8 Ref.

Descriptors: *Oil spills, *Weathering, *Water pollution effects, *Evaporation, Analytical techniques, Ice, Snow, Dissipation, Massachusetts, Resources development, Environmental effects, *Outer continental shelf, Fuel oil, Hydrocarbons.

Eleven ice and snow samples collected in the vicinity of the No 2 fuel oil spill from the barge Bouchard No 65 (Buzzards Bay, Massachusetts, 1977) were analyzed for saturated and aromatic hydrocarbons by high resolution gas chromatography. Similar analysis of samples from the Bouchard No 65 cargo indicated that the aromatic hydrocarbon level was somewhat less than that of the No 2 fuel oil spilled from the barge Florida in 1969. Weathering of alkanes and arenes was estimated by comparing quantitative changes in these hydrocarbons relative to the cargo oil. The arenes exhibited greater percent losses than the alkanes. Losses generally correlated with exposure of samples to the atmosphere. Overall oil losses were estimated by taking a weighted average of the alkane and arene loss estimates. (Sinha - OEIS)
W80-01147

FATE AND EFFECT OF BUNKER C OIL SPILLED BY THE USNS POTOMAC IN MELVILLE BAY - GREENLAND - 1977,
Greenland Fisheries Investigations, Charlottenlund (Denmark).
H. K. Petersen.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 332-343, 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Oil spills, *Weathering, *Water pollution effects, *Environmental effects, Water quality, Evaporation, Microbial degradation, Pollutant identification, *Outer continental shelf, *Greenland, Petroleum hydrocarbons, Dissolution, Tankers

On August 5, 1977, 380 tons of Bunker C fuel oil were spilled in Melville Bay, off Northwest Greenland. Studies of its fate and effects were conducted shortly after the spill occurred. The primary weathering mechanisms were evaporation and dissolution. Alkanes up to n-C17, and substituted naphthalenes, were depleted as much as 50 to 100% after 15 days of weathering. Tar flakes were observed sinking into the water column 10 days after the spill. Increased values of petroleum hydrocarbons in the water column were found in the immediate vicinity of the spill. Microbial degradation of the oil did not occur during the first two weeks. No immediate effect on the zooplankton was observed, but ingested oil was found in copepods and amphipods. No oiled birds and seals were observed, but oiled seals have been reported by local hunters. Oil from the seals has been analysed, and the oil might be identical to the oil spilled from the Potomac. (Sinha - OEIS)
W80-01148

EFFECTS OF AN OIL SPILL ON SALT MARSHES AT HARBOR ISLAND, TEXAS. I: BIOLOGY.
For primary bibliographic entry see Field 2J.
W80-01149

PHYSICAL ASPECTS OF THE OIL SPILL FROM THE SUPERTANKER 'METULA',
Texas A and M Univ., College Station.
R. W. Hann.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 355-363, 1 Fig, 5 Ref.

Descriptors: *Oil spills, *Environmental effects, *Water pollution effects, *Water quality, Beaches, Estuaries, Marshes, Intertidal areas, *Outer continental shelf, Strait of Magellan, Tierra del Fuego, Supertankers.

The oil spill from the supertanker Metula, the world's second largest at the time, serves as an important laboratory since cleanup operations were not carried out. The oil is disappearing at varying rates at different locations on Tierra del Fuego. The exposed coastline is hiding or dissipating the oil into the sea by wave turbulence, blowing sand, and deeper penetration into the beach. Beach detritus such as oiled kelp and kelp holdfasts, lumber and trash will probably be evidence of the spill for the longest time. In the estuaries and protected areas, the rate of change is much slower and confined to the aging and hardening of the oil by air exposure and deeper penetration into the sediments. Removal is evident only where greatest energy is exerted, i.e., high velocity flowing channels and exposed beach top areas. Some fossilized birds are still in evidence. Salicornia is beginning to recover and grow through some oil deposits where previous stalks were present. The magnitude of the Metula spill coupled with the absence of any cleanup activity has made the spill serve a valuable role as a test system to observe the recovery from a major spill. (Sinha - OEIS)
W80-01150

SINKING OF OIL IN LOS ANGELES HARBOR, CALIFORNIA FOLLOWING THE DESTRUCTION OF THE SANSINENA,
University of Southern California, Los Angeles. Environmental Geology Program.
R. L. Kolpack, R. W. Stearns, and G. L. Armstrong.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 379-392, 8 Fig, 22 Ref.

Descriptors: *Oil spills, *Sedimentation, *Sediment-water interfaces, Biodegradation, Environmental effects, Water pollution effects, Burning, Path of pollutants, Outer continental shelf, Los Angeles Harbor, Tankers.

Burning of the Bunker C fuel supply from the Sansinena following a fire and explosion aboard the vessel in Los Angeles Harbor on December 17, 1976 resulted in the sinking of residual material. Computer simulations of the fate of Bunker C exposed to high temperatures indicate that a loss of about 45% of the lower molecular weight material will increase the density of the remaining material so that it sinks rapidly in normal sea water. Subsequent modification of the remaining oil at the sediment/water interface by natural processes such as dissolution and biodegradation is extremely slow. The residence time of the sunken oil that remains in Los Angeles Harbor is therefore controlled primarily by the rate of burial by burrowing organisms and sediment accumulation. (Sinha - OEIS)
W80-01151

THE IMPACT OF THE SANSINENA EXPLOSION AND BUNKER C SPILL ON THE MARINE ENVIRONMENT,
University of Southern California, Los Angeles. Inst. for Marine and Coastal Studies.
D. F. Soule, M. K. Wicksten, J. K. Dawson, and M. Oguri.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17, June 1978. Coordinated by American Institute of Biological Sciences. p 394-443, 31 Fig, 3 Tab, 19 Ref.

Descriptors: *Oil spills, *Water pollution effects, *Water quality, *Environmental effects, Water quality, California, Toxicity, Baseline studies, Sediments, *Outer Continental Shelf, Los Angeles Harbor.

On December 17, 1976 the 70,000 ton tanker Sansinena exploded and burned in Los Angeles Harbor while refueling. The explosion and fire resulted in an estimated spill of 20,000 to 32,000 barrels of Bunker C fuel. Harbors Environmental Projects initiated studies on December 20 on the spread of the oil and its impact on biology and water quality at 24 stations. Studies by HEP at the site provided a baseline from 1972 to December 1976. Intertidal areas evidenced the greatest impact. Benthic population decreased greatly through April but returned to normal by November 1, 1977. Benthic organisms correlated best with oil and grease concentrations in bottom waters rather than in surface sediments, until November when hydrocarbons rose but no longer were correlated (toxic). (Sinha-OEIS)
W80-01152

THE FATE AND WEATHERING OF SURFACE OIL FROM THE BRAVO BLOWOUT,
Continental Shelf Inst., Trondheim (Norway).
T. Audunson.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17, June 1978. Coordinated by American Institute of Biological Sciences. p 446-475, 18 Fig, 1 Tab, 14 Ref.

Descriptors: *Oil pollution, *Water pollution effects, *Dispersion, *Evaporation, Model studies, Environmental effects, Weathering, Water quality, Resources development, *Outer continental shelf, *North Sea, Dissipation, Norway.

A description of the drift spreading, dissipation and weathering of the oil on the surface following the Bravo blowout is presented. Simulation of the drift, spread and dissipation of the oil on the surface is compared to field data. The dissipation computations are based upon a simple one parameter budget model. Tidal currents are included in the drift (spreading) computations. The results of the computations show fair agreement with the observations. Drift card releases and statistical computations are also presented which illustrate the fortunate timing of the spill with regard to coastal pollution. (Sinha - OEIS)
W80-01153

THE EKOFISK BRAVO BLOWOUT. PETROLEUM HYDROCARBONS IN THE SEA,
Institute of Marine Research, Bergen (Norway).
O. Grahl-Nielsen.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 477-487, 4 Fig.

Descriptors: *Oil spills, *Oil pollution, *Water pollution effects, *Water quality, Resources development, Environmental effects, Pollutant identification, Analytical techniques, *Outer continental shelf, *North Sea, Petroleum hydrocarbons, Ekofisk Bravo blowout.

The Ekofisk Bravo Blowout occurred the 22 of April, 1977. During seven and a half days before the well was capped approximately 20,000 tons of oil were released. Chemical, biological and physical oceanographic surveys were performed as well as special pollution investigations. One of the objectives was to study the spreading and distribution of petroleum hydrocarbons in the sea. The oil was present as oil-in-water emulsion and the analysis was carried out by gas chromatography with flame ionisation detection. With a mass spectrometer as detector on the gas chromatograph it was possible to identify and quantify alkylated naphthalenes, phenanthrenes and debenzothiophenes originating from the blowout over a large area. Using the same aromatics it was possible to distinguish tar balls of Bravo oil from tar balls of other origin, and also to exclude the Bravo oil as the source of pollution in some water samples collected south of Ekofisk in June. (Sinha - OEIS)
W80-01154

PRESENCE AND SOURCES OF OIL IN THE SEDIMENT AND BENTHIC COMMUNITY SURROUNDING THE EKOFISK FIELD AFTER THE BLOWOUT AT BRAVO,
Nalco Environmental Sciences, Northbrook, IL.; and Masspec Analytical Speciality Services Ltd., Stroud (England).
J. H. Johnson, P. W. Brooks, A. K. Aldridge, and S. J. Rowland.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 488-513, 11 Fig, 4 Tab, 29 Ref.

Descriptors: *Oil spills, *Oil pollution, *Water pollution effects, *Environmental effects, Sediments, Benthos, Pollutant identification, Analytical techniques, Resources development, *Outer continental shelf, Hydrocarbons, North Sea, Norway.

NALCO Environmental Sciences, at the request of the Phillips Petroleum Company, has undertaken an extensive environmental study to define possible contamination of the aquatic ecosystem by oil released during the Bravo blowout. Sediment and benthic samples, collected during the first phase of this study from a 100 mile square grid centered around the Ekofisk platform, have been processed to their isolate hydrocarbon fractions. These were analyzed by gas chromatography and gas chromatography/mass spectrometry to determine the presence of hydrocarbons attributable to Bravo crude. The analytical data obtained indicated hydrocarbons which could be linked to Bravo crude were present in the sediments and benthic samples at levels relatively low in comparison to hydrocarbons from other natural and manmade sources. (Sinha - OEIS)
W80-01155

BIOLOGICAL MONITORING OF SEDIMENTS IN EKOFISK OILFIELD,
Field Studies Council, Pembroke (England). Oil Pollution Research Unit.
J. M. Addy, D. Levell, and J. P. Hartley.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 515-539, 23 Fig, 3 Tab, 5 Ref, Append.

Descriptors: *Monitoring, *Water pollution effects, *Oil pollution, *Sediments, Environmental effects, Resources development, Aquatic life, *Outer continental shelf, North Sea, Ekofisk oilfield.

A biological monitoring scheme for the Ekofisk oilfield was initiated in 1973, based on intensive quantitative sampling of the benthic macrofaunal community close to the installations. Samples were taken with a 0.1 sq m grab and the biological material was screened with a 1 mm mesh. Sediment particle size analysis was carried out in all surveys, and hydrocarbon analysis of sediments from 26 stations was carried out in 1977. It is suggested that the observed changes in community structure are due to industrial activity in the area. Oil pollution and other factors such as mechanical disturbance and domestic waste are considered. An evaluation of this monitoring programme is presented. It is concluded that the methods used are adequate to detect and measure the spatial extent of changes which have occurred in the benthic macrofauna. (Sinha - OEIS)
W80-01156

THE EFFECTS OF THE EKOFISK BLOWOUT ON HYDROCARBON RESIDUES IN FISH AND SHELLFISH,
Torry Research Station, Aberdeen (Scotland).
K. J. Whittle, P. R. Mackie, J. Farmer, and R. Hardy.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 541-559, 6 Fig, 3 Tab, 9 Ref.

Descriptors: *Oil pollution, *Water pollution effects, *Fish, Shellfish, Environmental effects, Resources development, *North Sea, *Outer continental shelf, Hydrocarbon residues.

Demersal fish were trawled in the Ekofisk area in May just after the Ekofisk Bravo well was capped and again some two months later in July. In addition, cages containing mussels were suspended in the water column near the bottom and recovered a few days later. The fish flesh was assessed for oily taints after cooking and samples of muscle and liver tissues were analysed for aliphatic and aromatic hydrocarbons. Although two samples of addock caught initially showed signs of tainting at a low level, no taint was detected two months later. On both occasions the alkane concentrations in muscle and liver remained very similar to those found some years earlier during a baseline survey covering the North Sea. In May, but not in July, some analyses of the gut contents showed the presence of oil residues. The tissue samples which were analysed for selected two-to five-ring aromatic components gave individual concentrations below one nanogramme. (Sinha -OEIS)
W80-01157

THE INFAUNAL BENTHOS OF PETROLEUM-CONTAMINATED SEDIMENTS: STUDY OF A COMMUNITY AT A NATURAL OIL SEEP,
California Univ., Livermore. Lawrence Livermore Lab.
R. B. Spies, P. H. Davis, and D. H. Stuermer.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institue of Biological Sciences. p 736-

755, 10 Fig, 4 Tab, 19 Ref.

Descriptors: *Oil spills, *Seepage, *Sediments, *Benthos, Environmental effects, Water pollution effects, Resources development, California, *Outer continental shelf, Nothria-Tellina, Patiria miniata.

A diverse Nothria-Tellina assemblage exists in sediments containing 3,300 to 10,200 ppm of crude oil. Community changes over a two-year period are compared with those in a nearby non-seepage area. The faunas are similar, except for the high abundance of oligochaetes in the seep sediments. Several measures of community structure (diversity) indicate relative constancy between stations and seasonally. Several measures indicate relatively less community stability at the seep station. Sediment ATP concentrations were 809 mg ml-1 in areas of active seepage but only 146 to 402 mg ml-1 in other areas, which supports our earlier hypothesis of trophic enrichment. The water-soluble fraction of Prudhoe Bay crude oil is slightly more toxic to the larvae of the starfish Patiria miniata than is the seep oil. The described chemical differences between these oils are related to possible biological effects. (Sinha - OEIS)
W80-01158

ESTIMATION OF EFFECTS FROM OIL ON INTERTIDAL POPULATIONS: EXPERIMENTAL PERTUBATIONS VERSUS NATURAL VARIATION,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
J. R. Vanderhorst, J. W. Anderson, P. Wilkinson, and D. Woodruff.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 808-820, 6 Fig, 10 Ref.

Descriptors: *Oil spills, *Sediments, *Water pollution effects, Intertidal areas, Aquatic life, Environmental effects, Resources development, Evaluation, *Outer continental shelf.

Two experimental approaches to the investigation of effects of oil on intertidal population processes were evaluated in terms of effort required to quantitatively estimate effects of specific magnitudes. One approach used trays of oil-contaminated sediment placed in the low intertidal zone and subsequently treated in laboratory tanks. Three polychaete and two bivalve species were evaluated. It was concluded that quantitative studies would be feasible using the sediment tray approach but that the cost for high precision would be high. Quantitative studies with the bivalves using the sediment tray approach would be less expensive for given precision than would studies of polychaetes. (Sinha - OEIS)
W80-01159

POTENTIAL LONG-TERM EFFECTS OF PRUDHOE BAY CRUDE OIL IN ARCTIC SEDIMENTS ON INDIGENOUS BENTHIC INVERTEBRATE COMMUNITIES,
Louisville Univ., KY. Dept. of Biology.
M. Busdosh, K. R. Dobra, A. Horowitz, and S. E. Neff et al.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 856-874, 8 Tab, 41 Ref.

Descriptors: *Sediment, *Benthos, *Oil pollution, *Toxicity, *Environmental effects, Water pollution effects, Resources development, Weathering, *Outer continental shelf.

Laboratory and field experiments were performed to determine the potential toxicity of Prudhoe Bay crude oil to indigenous Arctic benthic invertebrates. Toxicity was measured as mortality and as sublethal behavioral changes in feeding, movement and burrowing activities. When sediment was contaminated with fresh Prudhoe Bay crude oil, burrowing activity of the amphipod Boeckosimus (=Onisimus) affinis was significantly reduced. Weathering of the oil was monitored by gas-liquid chromatography. Given a choice, in laboratory studies with oil contaminated or uncontaminated sediment, the amphipods selectively burrowed into the uncontaminated sediment. Exposure in experimental chamber to sediment contaminated with fresh oil also resulted in decreased movement and feeding activity during the month that the oil underwent initial weathering. Mortality rates were low for amphipods exposed to sediment contaminated with fresh or weathered oil. Behavioral changes in feeding and movement appear to be temporary and associated with the light hydrocarbons present in fresh crude oil. Inhibition of burrowing activities persisted beyond the time of initial oil weathering. Recolonization of in situ oil-contaminated sediment was monitored for 30 weeks. Amounts of residual oil were quantified using spectrofluorometric methods. The benthic community recolonizing oil contaminated areas was significantly different in species composition from that in unoiled reference areas. Amphipods avoided recolonizing oil contaminated areas. The preference for burrowing in unoiled substrate appears to be reflected in the avoidance of oil contaminated sediment in benthic community studies (Sinha - OEIS)
W80-01160

ACCUMULATION OF PETROLEUM HYDROCARBONS IN A SALT MARSH ECOSYSTEM EXPOSED TO STEADY STATE OIL INPUT,
Louisiana State Univ, Baton Rouge. Dept. of Marine Science.
C. S. Milan, and T. Whelan III.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 876-893, 4 Fig, 3 Tab, 31 Ref

Descriptors: *Oil pollution, *Ecosystems, *Environmental effects, Salt marshes, Water pollution effects, Estuaries, Resources development, Path of pollutants, *Outer continental shelf, Petroleum hydrocarbons.

Various biological components of a salt marsh ecosystem were examined for petroleum hydrocarbon accumulation. A site that has been exposed to steady state oil input for 30 years was compared to two control sites from known pristine areas. Three components of crude oil were considered: saturated alkanes, cycloalkanes, and aromatics. Cycloalkanes and aromatics were found to be a better indicator of oil accumulation than the n-alkanes. Benthic organisms, oysters and mussels, demonstrated the greatest enrichment of petroleum hydrocarbons, while the resident, free-swimming Fundulus gradis demonstrated the least petroleum enrichment. A scheme for the fate of spilled petroleum in an estuarine environment is proposed. The major adsorption site was marsh vegetation. Subsequent formation of petroleum-laden detritus appears to be the major transport mechanism of petroleum into the ecosystem. A fluorescence spectrophotometric technique is proposed, whereby the analysis of the total aromatic content of benthic organisms can be used for baseline data and monitoring studies after oil spills. (Sinha - OEIS)
W80-01161

ECOLOGICAL CONSEQUENCES OF PETROLEUM SPILLAGE IN PUERTO RICO,
Center for Energy and Environment Research, Mayaguez (Puerto Rico).
J. M. Lopez.
In: Proceedings of Conference on Assessment of Ecological Impacts of Oil Spills, held in Keystone, Colorado on 14-17 June 1978. Coordinated by American Institute of Biological Sciences. p 895-908, 3 Fig, 1 Tab.

Descriptors: *Oil spills, *Oil pollution, *Water pollution effects, *Environmental effects, *Coasts, *Ecosystems, Sediments, Resources development, Puerto Rico, Mangrove swamps, *Outer continental shelf, Coral reefs, Thalassia testudinum, Rhizophora mangle.

In order to develop an approach that can aid in assessing the impacts of oil spills, a typical Puerto Rican coastal environment is viewed in terms of its major marine ecosystem: coral reefs, seagrass beds and mangrove forests. Case studies of oil spills in Puerto Rico have involved comparison of abundance and diversity of organisms and species in spill areas versus carefully-matched, similar environs in no-spill areas. The relative vulnerability of these ecosystems has been demonstrated . Coral reefs are least impacted owing to their sub-tidal nature and high energy situation. Beds of the seagrass Thalassia testudinum exhibit relatively minor short-term effects. This comparative approach has shown, however, that oil coating of fringing stands of the red mangrove Rhizophora mangle and the associated intertidal communities of their prop roots impairs productivity and destroys the attached organisms. Oil becomes trapped and may not be retrieved or cleaned from the mangrove forest. Analysis by GC/IR of extracts from sediments within the mangal have shown the abundance and persistence of petroleum hydrocarbons in correlation with the absence of benthic organisms four years after an oil spill. (Sinha - OEIS)
W80-01162

GUIDELINES FOR SURFACE WATER QUALITY VOL 1 INORGANIC CHEMICAL SUBSTANCES PREAMBLE,
Department of the Environment, Ottawa (Ontario). Water Quality Branch.
S. W. Reeder
1979, 21 p, 5 Tab.

Descriptors: *Surface waters, *Water quality, *Water quality standards, *Water properties, Pollutants, Water pollution control, Inorganic compounds, Water utilization.

This report is the introduction to a series of water quality guidelines, to be published in three volumes as they become available. Volume 1 deals with inorganic chemical substances, Volume 2 with organic chemical substances and Volume 3 with physical, microbiological and radiological characteristics. The guidelines provide information on the source, occurrence and forms of basic water constituents and pollutants. A maximum concentration of the constituent is specified for each water use - public water supply, agricultural water supply, aquatic life, wildlife, aesthetics and recreation, and industrial water supply for the food processing industry. These limits are based on up-to-date scientific information and each one is chosen according to the most sensitive use. Each volume contains a preamble report similar to the present one. A master table lists the objectives for each water use for each of the constituents presented in that volume. The master table will be amended as additional information is produced and issued. The preamble also discusses the limitations of water quality use-objectives and their application in water pollution control programs. Tables for each water use compare published information from various sources on surface water quality limits. (WATDOC)
W80-01165

GUIDELINES FOR SURFACE WATER QUALITY VOL 1 INORGANIC CHEMICAL SUBSTANCES CHROMIUM,
Department of the Environment, Ottawa (Ontario). Water Quality Branch.
M. C. Taylor, S. W. Reeder, and A. Demayo.
1979, 9 p, 1 Fig, 1 Tab, 62 Ref.

Descriptors: *Chromium, *Inorganic compounds, *Surface waters, *Water quality, Toxicity, Public health, Aquatic life, Widlife, Livestock, Irrigation water, Recreation, Industrial water.

A literature survey was carried out on the toxic effects of chromium and chromium compounds on human health, aquatic life, plants and livestock The information is summarized in this publication From it, maximum chromium concentrations in water at which toxic effects will not appear are recommended. (WATDOC)
W80-01166

GUIDELINES FOR SURFACE WATER QUALITY VOL 1 INORGANIC CHEMICAL SUBSTANCES MERCURY,
Department of the Environment, Ottawa (Ontario). Water Quality Branch.
S. W. Reeder, A. Demayo, and M. C. Taylor.
1979, 16 p, 3 Fig, 3 Tab, 19 Ref, 1 Append.

Descriptors: *Mercury, *Inorganic compounds, *Surface waters, *Water quality, Toxicity, Public health, Aquatic life, Widlife, Vegetation, Livestock, Irrigation water, Industrial water, Recreation.

A literature survey was carried out on the toxic effects of mercury and mercury compounds on human health, aquatic life, plants and livestock. The information is summarized in this publication. From it, maximum mercury concentrations in water at which toxic effects will not appear are recommended. (WATDOC)
W80-01167

GUIDELINES FOR SURFACE WATER QUALITY VOL 1 INORGANIC CHEMICAL SUBSTANCES CADMIUM,
Department of the Environment, Ottawa (Ontario). Water Quality Branch.
S. W. Reeder, A. Demayo, and M. C. Taylor.
1979, 19 p, 144 Ref.

Descriptors: *Cadmium, *Inorganic compounds, *Surface waters, *Water quality, Toxicity, Vegetation, Public health, Aquatic life, Wildlife, Livestock, Sediments, Irrigation water, Industrial water, Recreation.

A literature survey was carried out on the toxic effects of cadmium and cadmium compounds on human health, aquatic life, plants and livestock. The information is summarized in this publication. From it, maximum cadmium concentrations in water at which toxic effects will not appear are recommended. (WATDOC)
W80-01168

A CHAMBER FOR IN SITU EVALUATIONS OF PERIPHYTON PRODUCTIVITY IN LOTIC SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
J. J. Rodgers, Jr., K. L. Dickson, and J. Cairns, Jr.
Archiv fur Hydrobiologie, Vol 84, No 3, p 389-398, November 1978. 4 Fig, 1 Tab, 27 Ref. ERDA-E-(40-1)4939.

Descriptors: *Periphyton, *Productivity, *Testing, *Equipment, *Measurement, *Laboratory equipment, Algae, Photosynthesis, Instrumentation, Virginia, Evaluation, Analytical techniques, Testing procedures, Benthic flora, Primary productivity, Lotic environment, Currents(Water).

After a year of intensive use, a test chamber for in-situ periphyton primary productivity measurements in lotic systems still functioned and needed only minor repairs. The chamber incorporates an internal variable-speed pump to insure mixing and is constructed of sturdy inexpensive materials. Pump operating range corresponds to 0.062 to 0.187/min turnover rates. Twelve light and dark chambers were tested August to November 1975 with pumps running (simulated flowing) and pumps disengaged (static) in New River at Glen Lyn, Virginia. Carbon assimilation measurements were significantly greater in simulating flowing chambers (25-20 mg C/sq/m/h) as compared to static nonflowing chambers (14-10 mg C/sq/m/h). From no-flow to 120 ml/min volumetric flow rates, primary productivity increases 31%. Maximum photosynthesis rates are achieved at 240 ml/min volumetric flow rate (0.124/min turnover rate). Carbon assimilation results are linear with time. Chamber oxygen concentration remain high during field tests; light chamber laboratory tests are 98.8% oxygen saturated after 4h and supersaturated at experiment termination, experiments in dark chambers reduce oxygen concentrations from 94.2 to 71.3% saturation. In-situ incubation is advantageous because it incorporates differences in light, temperature, and other environmental factors. Varying flow in chambers allows more realistic primary production estimates since current is a governing factor. (Danovich-Wisconsin)
W80-01173

ENVIRONMENTAL IMPROVEMENT AT NEROUTSOS INLET, B. C. VOLUME 1 SUMMARY REPORT,
Rayonier Canada (B.C.) Ltd., Port Alice.
For primary bibliographic entry see Field 5A.
W80-01192

ENVIRONMENTAL IMPROVEMENT AT NEROUTSOS INLET, B.C. VOLUME 2 WATER QUALITY AND BIOLOGICAL STUDIES IN NEROUTSOS INLET, B.C.
ITT Rayonier Inc., Shelton, WA. Olympic Research Div.
For primary bibliographic entry see Field 5B.
W80-01193

ENVIRONMENTAL IMPROVEMENT AT NEROUTSOS INLET, B.C. VOLUME 4 ASSESSMENT OF SHORELINE REHABILITATION AT THE PORT ALICE PULP MILL,
Victoria Univ. (British Columbia). Dept. of Biology.
D. V. Ellis, S. F. Cross, K. Coates, and S. Mckinnell.
Rayonier Canada, Port Alice, British Columbia, 1978, 91 p, 19 Fig, 10 Tab, 8 Ref, 5 App.

Descriptors: *Pulp & paper industry, *Pulping wastes, *Marine benthos, Water Quality, Neroutsos Inlet, Vancouver Island, Water pollution effects, Industrial wastes, Port Alice, Estuaries, Monitoring, Animal populations, Oligochaetes, Amphipods, Marine algae, Intertidal areas, *Shoreline biology, Food chain, Periphyton, Diatoms.

The Marine Environmental Group at the University of Victoria is developing an array of tests to monitor rehabilitation on shore around the Port Alice pulp mill. Three tests have been developed and implemented in 1978. They comprise species associational analyses of gammaridean amphipods and enchytraeid oligochaetes, and shoreline colour photographic recording supported by biological surveys. These tests show that subtle impacts on shoreline biology presently extend throughout Neroutsos Inlet some 15 km from the mill, although major changes in the natural ecosystem are restricted to within 5-6 km of the mill. At the 2 km distance normal dominant mid-tide level rockweed(Fucus) growth begins to disappear with its contributions to primary production and shelter for epifauna, and is replaced by a higher elevation green filamentous Enteromorpha sheltering far less epifauna. At a distance of 300 metres from the mill there is a further major reduction in the ecosystem as Enteromorpha is replaced by 'slimes' of filamentous algae, Ulothrix and Oscillatoria, a biologically abnormal amphipod population consisting of uniformly small and evenly dispersed beach fleas (Orchestia traskiana) and a reduced Enchytraeid population of one species only (Lumbricillus lineatus). (Katz-EIS)
W80-01194

ENVIRONMENTAL IMPROVEMENT AT NEROUTSOS INLET, B.C. VOLUME 5 MIGRATORY STUDIES OF JUVENILE SALMONIDS IN UPPER NEROUTSOS INLET, 1978,
Beak Consultants Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 5A.
W80-01195

ENVIRONMENTAL IMPROVEMENT AT NEROUTSOS INLET, B.C. VOLUME 6 ACUTE AND CHRONIC EFFECTS OF PORT ALICE SULFITE MILL EFFLUENT TO FISH,
E.V.S. Consultants Ltd., Vancouver (British Columbia).
G. Vigers, W. Cave, and R. Janssen.
Rayonier Canada, Port Alice, British Columbia, Canada, 1978, 59 p, 23 Fig, 26 Tab, 33 Ref.

Descriptors: Bioassay, Laboratory tests, Mortality, Fish behavior, *Salmon, Fish migration, *Pulp & paper industry, *Pulping wastes, Water quality, Neroutsos Inlet, Vancouver Island, Water pollution effects, Industrial waste, Port Alice, Chum salmon, Herring, Biomass, Rainbow trout, Coho salmon, Juvenile fish, Growth, *Sulfite pulping wastes.

The overall objective of this study was to determine the acute and chronic effects (lethality, avoidance and growth) of the Port Alice sulphite mill effluent (SME) through a program of field and laboratory studies. This study showed that 'end of pipe' toxicity and chemical data on the major mill outfalls can be related to concurrent in situ survival and avoidance bioassays using preference/avoidance chambers with juvenile chum, herring anu coho smolts as test organisms. It was found that the effects of SME extended predominantly North of the outfall locations. In the vicinity of the mill where SME is present at a high concentration in the surface water, the juvenile fish preferred subsurface water, and substantial mortality was encountered up to 1/4 to 1/2 mile from the mill outfalls in the preference/avoidance chambers. From these distances to beyond 1 1/4 miles from the mill outfall, mortalities were reduced or nonexistent, although a preference for subsurface waters was still observed. Beyond a half mile from the outfalls, fish increasingly preferred the surface meter of the water. Laboratory studies utilizing juvenile chum demonstrated effects of SME on growth at concentrations. The concentrations of SME used in the growth studies were related to the acute lethal toxicity at the 'end of pipe', and based on theoretical dilution factors which would be required to reach the levels of SME used in the growth studies, a postulated zone of influence was constructed showing the maximum extent of observed effects. (Katz-EIS)
W80-01196

EMBRYO-LARVAL TOXICITY TESTS WITH ORGANIC COMPOUNDS,
Thomas Hunt Morgan School of Biological Sciences, Lexington, KY.
For primary bibliographic entry see Field 5A.
W80-01197

PRODUCTIVITY AND ABUNDANCE OF ULTRA-AND NANOPLANKTON IN OSLOFJORDEN,
Oslo Univ., Oslo (Norway).
J. Throndsen.
Sarsia, Vol 63, No 4, p 273-284, 1978. 7 Fig, 5 Tab, 25 Ref.

Descriptors: *Productivity, *Nannoplankton, *Fjords, *Oslofjorden, Norway, Plankton, Primary productivity, Growth rates, On-site investigations, On-site data collections, Diatoms, Chlorophyll, Aquatic productivity, Aquatic microorganisms.

This April 1972-August 1974 investigation of six stations in Oslofjorden, Norway, assesses the primary production and importance of nannoplankton and ultraplankton by means of laboratory and in-situ incubations. Production per unit water surface per year varied by a factor of 100 in the outer fjord and 300 in the inner fjord. Primary production values were up to five times greater in the inner part than the outer part. Summer daily production was 2.8 g C sq m (inner fjord) and 0.6 g C sq m (outer fjord). Sampling frequency was every five weeks and plankton passing through a five micro m mesh were termed ultraplankton and those passing a 45 micro m mesh, nannoplankton. Small centric and pennate diatoms were abundant in all seasons. Skeletenoma costatum, an important fjord species, appeared in all size fractions and Micromonas pusilla was an abundant ultraplankton species. Primary production was mostly confined to the uppermost 2-4 m. Using laboratory measurements, the ultraplankton fraction contributed about half the total surface water primary production, varying between 15 and 89%. In-situ relative measurements for nanoplankton ranged 14% to 100% primary production per sq m. Ultraplankton contributed about 14 and 91mg C sq m h (or 5% and 32% of the total). Ultraplankton minima both years

occurred in March and was clearly related to the spring bloom of chain-forming net plankton diatoms. (Danovich-Wisconsin)
W80-01199

5D. Waste Treatment Processes

THROTTLE SHAFT FOR THE CONTROLLED DISCHARGE OF DAMMED-UP WATER,
Schulze (Oswald) G.m.b.H. and Co., KG. (Germany,F.R.). (Assignee).
W. Jakobi.
U.S. Patent No 4,151,859, 8 p, 4 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 88-89, May 1, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Flow control, Reservoir releases, Sewerage, Flow system, Equipment.

The throttle shaft for the controlled discharge of dammed-up water, especially for the controlled flow of sewage and waste water to sewage-processing units, comprises a housing formed with an inlet and an outlet for a float-controlled throttle flap at the inlet regulating the flow of water into the housing in response to the water level therein. The housing is provided with a throttle channel for the water which connects with the outlet and is provided with an adjustable shutter shiftable between a fully closed and a fully open position to vary the flow cross section of this channel or passage. (Sinha-OEIS)
W80-00874

APPARATUS AND METHOD FOR REMOVAL OF SOLUBLE METAL IONS FROM AQUEOUS EFFLUENT,
London Lab. Ltd., Woodbridge, CT. (Assignee).
J. F. Soltys, and H. L. Heard.
U.S. Patent No 4,152,229, 8 p, 11 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 208-209, May 1, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, Metals, Electrolysis, Electrodes, Ion transport, Equipment, Galvanizing.

A method for removal of soluble metals ions is provided by treatment of effluent by adjusting the pH to a reactive level which is highly acidic, and preferably between 2.0-3.5. The effluent is then passed continuously through the apparatus so that it flows through and in close contact with high surface area acceptor and donor electrodes which are in physical contact. Due to the galvanic action of these electrodes in contact with soluble metal ions in the effluent solution, the metal ions are plated onto the acceptor electrode and thereby removed from solution. The effluent then flows through an outlet which is positioned just below the level of the uppermost portion of the electrodes. The treated effluent then may be further treated or directly recycled into the environment, as may be desired. The apparatus comprises a chamber having an inlet and outlet to facilitate continuous flow. The electrodes are configured so as to expose a high surface area, preferably either as screens or expanded or perforated sheets of materials, thereby permitting maximum contact with the effluent. (Sinha-OEIS)
W80-00876

BACKFLUSHING METHOD,
Clevepak Corp., White Plains, NY. (Assignee).
A. E. Molvar.
U.S. Patent No 4,152,259, 9 p, 8 Fig, 15 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 218, May 1, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial waste, Aeration, Turbulence, Mixing, Equipment, Pumps, Sewage, Backflushing.

A method utilizing a submerged system for efficiently mixing gas with waste water and for flushing accumulated debris from the system is described. Waste water is aerated by pumping through submerged tubes with openings through which air is drawn or pumped into the tubes to create turbulent mixing. Since submerged systems of this type normally pump a great volume of water, even a small number of particles in a large basin will eventually become lodged within the mixing chambers. These systems can be flushed of such debris by directly or indirectly connecting the inlets of each of the mixing chambers to which waste water is normally supplied for aeration to a higher, backflush location closer to or above water surface. If the pump is turned off while air continues to flow into the chambers, the difference in pressure between the water at the mixing chambers and the higher locations causes flow of the air backward through the inlets to that back-flush location to flush the system. Surprisingly, the air pumps waste water at a substantial flow rate and pressure backward through the system. A separate line can be used with a valve to flush the debris directly above the surface where it can be collected. The waste water can be backflushed through the pump to clean the pump screen provided that the pump and its strainer are mounted above the mixing chambers. (Sinha - OEIS)
W80-00878

FILTER FOR TREATMENT OF NATURAL AND WASTE WATER,
Leningrad Communal Agriculture Academy Research Inst. (USSR)
Y. B. Lazovsky, and M. G. Novikov.
U.S. Patent No 4,152,266, 8 p, 5 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 220, May 1, 1979.

Descriptors: *Patents, *Waste water treatment, *Water treatment, Water pollution treatment, Water quality control, Water purification, Filtering, Filters, Equipment, Granular filters

A filter for treatment of natural and waste water comprises a housing accommodating a granular filter body. A draining-distributing system is arranged within the lowermost bed of the filtering body. A system of ducts is mounted in the housing above the filtering body which provides positive distribution of water over the whole length of the filter. As a result of the uniform distribution of the water over the surface area of the filtering body, displacement and mixing of the gravel beds is precluded, and formation of unwashable zones in the filtering body is substantially prevented (Sinha-OEIS)
W80-00881

METHOD OF TREATING ORGANIC WASTE WATER,
Marinaga Engineering Co. Ltd., Tokyo (Japan).
K. Okada, H. Yamamoto, S. Teraguchi, and N. Ishibashi.
U.S. Patent No 4,153,544, 7 p, 1 Fig, 6 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 649, May 8, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Organic wastes, Aeration, Temperature, Activated sludge, Aerobic conditions, Nitrogen, Carbon.

A method of treating organic waste water in an aeration tank is characterized by the fact that (1) the dissolved oxygen content in the aeration tank is adjusted to be within the range of 1.5-4.5 ppm; (2) the temperature of the waste water is controlled to be within the range of 15-40C, and the residence time of the waste water in the aeration tank is set at ten or more days if the ratio of the total carbon content to the nitrogen content of the organic materials is not less than 5, and the temperature of the waste water is controlled to be within the range of 20-40C and the residence time of the waste water in the aeration tank is set at ten or more days if the ratio of the total carbon content to the nitrogen content of the organic materials is less than 5 and not less than 2.5; and (3) the activated sludge content in the aeration tank is kept constant by controlling the amount of COD to be removed. (Sinha-OEIS)
W80-00884

PROCESS FOR CONTROLLING POLLUTION AND CONTAMINATION IN THE ELECTRODEPOSITION OF PAINT,
Nalco Chemical Co., Oak Brook, IL. (Assignee).
S. W. Forney.
U.S. Patent No 4,153,548, 4 p, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 650, May 8, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, Chemical reactions, Filtration, Paints, Water reuse, Silica, Polymers.

Pollution and contamination in waste water, including drippings and wash water, from articles painted by electrodeposition are controlled by adding to the waste water an acidic silica sol and a water dispersible coagulating polymer in an amount sufficient to reduce the tackiness of the paint solids and thereby reduce the tendency of the paint solids to adhere to surrounding surfaces and at the same time conditions the solids so that they can be readily removed from the water. The separation of the solids from the water can be effected by vacuum filtration and the filtrate can be used over again as a part of the water employed in the washing process. (Sinha-OEIS)
W80-00886

METHOD OF TREATMENT OF WASTE WATER CONTAINING SULFUR COMPOUNDS,
Hitachi Ltd. (Japan). (Assignee); Hitachi Plant Engineering and Construction Co., Ltd. (Japan). (Assignee); and Babcock-Hitachi K.K., Tokyo (Japan). (Assignee)
K. Otani, S. Nishimura, T. Sawa, S. Kikkawa, and I. Shimokobe.
U.S. Patent No 4,154,673, 8 p, 6 Fig, 2 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1026, May 15, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Separation techniques, Sulfur compounds, Ion exchange, Anion exchange, Regeneration, Thionic acid ions.

Waste water issued from a wet type desulfurization apparatus and containing thionic acid ions is introduced into ion-exchange towers filled with weak-basic anion-exchange which has to effect anion exchange therein. The weak-basic anion-exchange resin which has adsorbed the thionic acid ions is desorbed by contacting an alkaline solution. The tionic acid ions included in the desorbing solution are decomposed by heating them in the presence of acid. A decomposed solution is issued out of the system after its neutralization. (Sinha-OEIS)
W80-00895

SKIMMER DEVICE,
L. T. Kole
U.S. Patent No 4,154,678, 7 p, 6 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1028, May 15, 1979.

Descriptors: *Patents, *Water pollution treatment, *Water quality control, Oil pollution, Skimming, Pollutants, Equipment.

An apparatus for removing floatable material from the surface of water includes a hollow receptacle having a continuous side wall and a bottom having an opening centrally located. A pump is mounted within the hollow receptacle so that the pump inlet is positioned over the receptacle bottom opening and the pump outlet is connected to an exhaust conduit line mounted in the side wall and extending outwardly to a container or sump. The receptacle is positioned so that the top rim of the side receptacle wall rides at the surface of the carrier fluid or water so that floatable material, solid or liquid, is transferred over the rim into the receptacle. For solid materials, an opening is provided in the receptacle bottom for flowing upwardly into the receptacle to combine with the skimmed solid floatable substance for pumping outwardly of the receptacle through the exhaust conduit line. (Sinha-OEIS)

W80-00896

GRAVITY FLOW SEPTIC TANK SYSTEM,
O. Marcotte.
U.S. Patent No 4,154,685, 6 p, 4 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1030, May 15, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, Septic tanks, Domestic wastes, Biodegradation, Flow, Scum.

The invention provides a septic tank system of greatly improved effectiveness in maintaining optimum bacterial action for a maximum length of time by utilizing series connected tanks with the water level in each successive tank being lower than that in the first tank so that gravity flow is established between the successive tanks. A transfer means is provided between each of the successive tanks comprising one or more horizontal pipes having their inlet ends closed, and each horizontal pipe having one or more horizontal slots formed in the wall at a level above the bottom of the pipe bore to permit the removal of scum through the slops in entrainment and/or suction action of the fluid flowing through the transfer pipe, thereby permitting gases to freely escape through the scum from the effluent surface of each tank and preventing the deleterious effects of trapped gases upon the biodegradation action normally produced in each successive septic tank. (Sinha-OEIS)
W80-00899

TREATMENT OF PULP MILL EFFLUENTS,
Rhone-Poulenc S.A., Paris (France). (Assignee).
B. Ancelle, and S. Lambert.
U.S. Patent No 4,155,845, 4 p, 12 Ref; Official Gazette of the United States Patent Office, Vol 982, No 4, p 1415-1416, May 22, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Pulp wastes, Separation techniques, Filtration, Sodium compounds, Pulp and paper industry, *Ultrafiltration.

Pulp mill effluents, particularly soda-containing treatment liquors, are subjected to a separatory treatment comprising a pre-treatment with flocculating agent in a sub-critical amount incapable of effecting flocculation, followed by an ultrafiltration of the pre-treated effluent. (Sinha - OEIS)
W80-00902

VACUUM DRAINAGE SYSTEM,
Electrolux G.m.b.H. (Germany, F.R.). (Assignee).
H. R. Michael.
U.S. Patent No 4,155,851, 5 p, 1 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 982, No 4, p 1417-1418, May 22, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Aeration, Sewerage, Equipment, Valves, Suction valves.

A vacuum drain system includes a collecting tank and a sewage drain vacuum conduit line for conveying sewage from service connections to the collecting tank under the influence of vacuum in the system. Each service connection for admitting sewage includes a suction valve which also admits a volume of air to facilitate movement of sewage in the system. In order to prevent accumulation of sewage during prolonged periods of low usage of the system, such as at night, an auxiliary aeration system is provided for introducing a volume of air independently of the air admitted through operation of the suction valves. In order to control the proposed aeration arrangement in a desired manner, sensing devices are placed at suitable places along the vacuum line which produce a control signal whenever the water level in a rising section of the line reaches a certain level. (Sinha - OEIS)
W80-00903

PROCESS AND APPARATUS FOR REMOVAL OF IMPURITIES FROM LIQUIDS,
G. J. Nieuwenhuis.
U.S. Patent No 4,156,647, 7 p, 3 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1692, May 29, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Heavy metals, Separation techniques, Filtration, Ion exchange, Adsorption, Equipment.

This invention provides a unit for removal of impurities from liquids, the impurities generally present in small quantities, by contacting the liquid with a loose, particulate treating material which acts to remove the impurity from the liquid stream by reaction, by ion exchange or by adsorption. The treating material such as a naturally occurring polysaccharide polymer, is held in a vessel having a wall with multiple small openings, each filled with an inert, compact, finely-divided filter material. Means are mounted within the vessel to progressively sweep over the inner surface of the wall just out of contact and over the openings in which the particulate filter material is retained to remove impurities lodged thereon and prevent blinding of the filter material by such impurities. The same means also acts to uniformlymix the particulate treatment material held within the vessel. The liquid with the impurities removed, because of the pressure differential between the inside and outside of the vessel, passes through the particulate filter material retained in the small openings of the vessel and is discharged from the housing surrounding the vessel. The treating material, once spent, is replaced as necessary. (Sinha - OEIS)
W80-00909

FLOTATION DEVICE WITH PRETREATMENT,
Office of the Secretary of the (Navy), Washington, DC.
T. A. Kuepper.
U.S. Patent No 4,156,648, 7 p, 3 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1692-1693, May 29, 1979.

Descriptors: *Patents, *Water treatment, *Waste water treatment, *Water pollutiontreatment, *Water purification, Separation techniques, Centrifugation, Coagulation, Flocculation, Filtration, Aeration, Ozone, Bubbles, Foam separation.

Methods and apparatus for treating water/wastewater to remove grit, suspended and colloidal solids of organic and inorganic nature, microorganisms and surfactants are described. Dense suspended solids (grit) are first removed by a centrifugation process. The influent water/wastewater is then passed through coagulation and flocculation chambers, an upflow clarifier and a high-rate settling chamber for final sedimentation. Next, the influent passes through a foam filter to remove colloidal particles. The water/wastewater under treatment is then pressurized and saturated with air and subsequently depressurized, causing the dissolved gas to bubble out of solution floating out suspended contaminants. At this point, ozone is introduced into the influent to create a thicker, more dense foam by oxidizing organic matter and for disinfection purposes. The foam floated to the surface of the influent is scraped off and furnishes the foam for the foam filter. (Sinha - OEIS)
W80-00910

GENERATION AND EVALUATION OF ALTERNATIVE PLANS FOR REGIONAL WASTEWATER SYSTEMS: AN IMPUTED VALUE METHOD,
Louisville Univ., KY. Dept. of Chemical and Environmental Engineering.
M. Nakamura, and E. D. Brill Jr.
Water Resources Research, Vol 15, No 4, p 750-756, August 1979. 4 Fig, 3 Tab, 10 Ref.

Descriptors: *Alternative planning, *Evaluation, *Waste water treatment, *Branch-and-bound-method, *Optimization, Methodology, Algorithms, Constraints, Mathematical models, Systems analysis, Equations, Regional systems, Cost minimization, Location problems, DuPage County(IL), Economic trade-offs.

A branch-and-bound method for use in planning regional wastewater treatment systems is extended to include a methodology for generating and evaluating alternative plans. Since many planning issues are related to a specific configuration of regional facilities, economic trade-offs among alternative plans are evaluated using imputed values of individual facilities or groups of them. The imputed values, or bounds on them are calculated from information contained in the branch-and-bound tree using an 'imputed value incidence matrix.' The general approach, which can be applied to other public facility location problems, is designed to aid an analyst in gaining more insights into the problem under study than obtainable from conventional optimization methods. The procedure is designed for use within a larger planning process where the steps are to generate, to evaluate, and to elaborate on alternative plans. The method is illustrated using the regional wastewater system for DuPage County, Illinois. (Bell-Graf--Cornell)
W80-00982

A STUDY OF THE IN-SITU INDIRECT FREEZING PROCESS,
New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
For primary bibliographic entry see Field 3A.
W80-01006

A STUDY OF THE VACUUM-FREEZING HIGH PRESSURE ICE-MELTING PROCESS,
New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
For primary bibliographic entry see Field 3A.
W80-01007

THE ANALYSIS OF NITROGEN FORMS IN WATERS AND WASTEWATERS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 5C.
W80-01127

AERATION METHOD AND SYSTEM,
Clevepak Corp., White Plains, NY. (Assignee).
A. E. Molvar.
U.S. Patent No 4,157,304, 9 p, 8 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 983, No 1, p 132, June 5, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Aeration, Oxygen, Mixing, Bubbles, Turbulence, Equipment.

The invention relates to an improved method and system for mixing a gas such as oxygen or air with waste water. The system includes mixing chambers which are placed below the surface of the waste water and through which the water is pumped from an inlet to an outlet. A suitable gas, such as oxygen or air containing oxygen, is injected into each of the mixing chambers at a step surface to form parallel streams of air and water in an extending chamber. As the two streams move down the extending chamber, the interface between the two streams becomes unstable and waves form which attach to the sides of the chamber. This causes large frictional stresses, creating tiny bubbles which mix with the water. Since the water and air essentially flow in the same direction, no energy is wasted in turbulence and the system is energy efficient. The mixing chamber is preferably tapered in the down stream direction, first gradually and then radically, to ensure that the vortices created by the mixing do not extend out of the chamber which would reduce the efficiency of the mixing. Further, helical vanes are preferably provided in the injection passages for the gas to create greater wave generating conditions which extend the operating range of the device to greater air flow rates. (Sinha-OEIS)
W80-01174

BIOLOGICAL WASTE WATER TREATMENT APPARATUS AND A METHOD OF PRODUCING THE SAME,
Dengyosha Machine Works, Ltd., (Japan). (As-

signee).
N. Yoshikawa, and R. Suzuki.
U.S. Patent No 4,157,303, 7 p, 10 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 983, No 1, p 132, June 5, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Biological treatment, Microbial degradation, Equipment.

A waste water treatment apparatus includes broad surface areas of rotating assemblies for attaching microorganisms in spite of its short axial dimension to achieve the high performance of purification without increasing the driving power. The device comprises at least one rotating disc assembly rotatively driven while its lower halves are immersed in the waste water. Impellers are arranged in parallel side by side on a main shaft, and each impeller comprises two parallel discs fixed to the main shaft, one of the discs being formed at its center with a suction opening and impeller blades radial to the main shaft between the two discs. The impeller is divided into a number of sectors consisting of two sector side plates and two impeller blades which are integrally formed by blow molding and then arranged side by side to form a sector block. The thus produced sector blocks are then arranged about the main shaft and fixed to form a rotating disc assembly. (Sinha-OEIS)
W80-01175

METHOD AND APPARATUS FOR TREATING LIQUID-CONTAINING SUBSTANCE MIXTURES, PARTICULARLY FIBRE SUSPENSIONS,
Sunds Aktiebolag, Sundsvall (Sweden). (Assignee).
K. E. Bergstedt.
U.S. Patent No 4,157,302, 12 p, 14 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 983, No 1, p 131-132, June 5, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Pulp wastes, Cellulose, Separation techniques, Flow, Flow separation, Membranes, Equipment.

The invention related to a method and an apparatus for separating liquid from mixtures of substances, preferably fiber suspension such as cellulose pulp, particularly, in connection with washing or treatment of the suspension. The liquid-containing substance flows in a first direction so that at least a portion of the liquid can be separated from the liquid-containing substance through the separating means. The liquid is withdrawn from the substance through the separating means in a second direction, intermittently interrupting the flow of the liquid downstream from the point of removal from the separating means so as to terminate the flow of the liquid and preventing the return flow of at least a portion of the separated liquid through the separating means. An apparatus is provided for directing the flow in the first direction, separating means for separating at least a portion of the liquid in a second direction, means for interrupting the flow of a separated liquid at a point downstream of the separating means and means for preventing the return flow of separated liquid through the separating means. Membranes are provided for preventing return flow of the liquid. The separating means comprises a screen member substantially parallel to the flow of the liquid in the first direction. The membrane is located on the downstream side of the screen member. (Sinha-OEIS)
W80-01176

PROCESS FOR THE PURIFICATION OF PHENOL AND PHENOL FORMALDEHYDE CONTAINING WASTE WATER,
Deutsche Gold- und Silber-Scheideanstalt A. G., Frankfurt-am-Main (Germany, F.R.). (Assignee).
H. Junkermann, and V. Hafner.
U.S. Patent No 4,157,300, 8 p, 26 Ref; Official Gazette of the United States Patent Office, Vol 983, No 1, p 131, June 5, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Chemical reactions, Phenols, Alkaline earth metals, Color, Formaldehyde.

Phenol or phenol-formaldehyde containing waste water is purified with chlorine dioxide by treating the waste water with alkali or alkaline earth metal chlorite in the presence of formaldehyde and the weight ratio of formaldehyde to phenol is between 0.5 to 2:1 and the mole ratio of the sum of phenol + formaldehyde to chlorite is between 1:1.2 to 1:2, whereupon the treated water is decolorized, in a given case in a known manner. (Sinha-OEIS)
W80-01177

WASTE WATER-TREATING METHOD,
Kureha Kagaku Kogy Kabushiki Kaisha, Tokyo (Japan). (Assignee); and Toyo Boseki Kabushiki Kaisha, Osaka (Japan). (Assignee).
Y. Amagi, and S. Inada.
U.S. Patent No 4,159,244, 7 p, 2 Fig, 4 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 811-812, June 26, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Adsorption, Activated carbon, Flow, Particle size, Fluidized bed.

A waste water-treating method is provided which comprises passing an aqueous liquid, in an upward direction and at a suitable flow velocity, through a bed consisting of activated carbon whose particle diameter ranges between 0.20 and 1.5 mm and whose width of particle size range (or substantial difference between the largest ones and the smallest ones) is chosen to be 0.30 mm or more. The waste water is always made to contact the adsorption section of the fluidized bed. The linear velocity of the waste water is controlled so as to cause the expansion ratio of a fluidized bed of granular activated carbon to fall within the prescribed range. (Sinha-OEIS)
W80-01178

METHOD FOR RECOVERY OF METALS FROM METAL PLATING BATHS AND NEUTRALIZING TOXIC EFFLUENTS THEREFROM,
Instytut Mechaniki Precyzyjnej, Warsaw (Poland) (Assignee).
F. Tuznik, and A. Lis
U.S. Patent No 4,157,942, 7 p, 1 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 983, No 2, p 356, June 12, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Metals, Separation techniques, Chemical precipitation, Filtration, Equipment, Water reuse, Chromium, *Product recovery, Metal plating industry, Cyanide.

A method and apparatus for thorough neutralization of all plating bath solutions and effluents and for full recovery of used plating metals is provided. Hexavalent chromium is reduced to trivalent chromium with production of chromium hydroxide. Metals such as zinc and cadmium are recovered as their respective hydroxides; silver and copper are recovered as free metals. Additionally, the invention provides for neutralization of cyanide and chromic fumes exhausted from the reclaiming tanks. The pH of the reclaiming bath is adjusted from 3.0 to 13.0, and an aldehyde, and/or ozone, is introduced into the reclaiming bath. The fumes from the reclaiming tank are introduced into the fume extraction ducts which carry the cyanide fumes in the form of hydrogen cyanide. Regeneration of the plating bath, the reclaiming bath, and the rinse water is effected according to conventional methods. The method and apparatus of the invention provide for disposal of all of the post-reaction solutions and rinse water effluents via the common drain system to the final pH-adjustment unit. By the time the effluent reaches the drain system, the effluent is free of cyanide and hexavalent chromium as well as of heavy metals. As filtration and purification of the plating bath, the reclaiming bath, and the rinse water are carried out within the closed-loop system, consumption of fresh water is reduced to 2-10% of the amount required in present systems. (Sinha-OEIS)
W80-01181

COMBINED WASTE WATER CLARIFICATION AND TRASH DISPOSAL SYSTEM,
A. H. Borst.
U.S. Patent No 4,157,961, 17 p, 9 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 983, No 2, p 361, June 12, 1979.

Descriptors: *Patents, *Wastes water treatment, *Industrial wastes, *Water pollution treatment, *Separation techniques, Water purification, Filtration, Incineration, Carbon, Activated carbon, Water reuse, Equipment.

Polluted waste water is combined with shredded trash including organic trash components to form a water-trash mixture from which inorganic substances such as sand are initially gravitationally settled out and removed. The trash-water mixture is then passed into a roughing filter constructed of individual, replaceable filter elements stocked with non-activated carbon to remove floating and suspended particulate matter. Water is then flowed through a fine filter, also constructed of individual filter elements but stocked with activated carbon for the removal of remaining particulate matter as well as dissolved substances. The filter elements are intermittently regenerated by heating the coal and the residue deposited thereon under an oxygen deficiency to degas organic matters of the residue and form additional filter carbon, both non-activated and activated carbon. Trash may further by separately incinerated, also under an oxygen deficiency to generate heat for the degassing process and to generate additional combustible gas which is used to drive motors or turbines for generating electricity. Motor exhaust gas is used to predry the carbon in filter elements about to be regenerated by passing the gas through the elements. This also removes particulate contaminants from the exhaust gas. A preferred high temperature activated carbon filter backwashing method employing heat from the exhaust gas is also described. (Sinha-OEIS)
W80-01182

SETTLING TANK STRUCTURE,
Texaco Inc., NY. (Assignee).
H. J. Thies.
U.S. Patent No 4,157,969, 6 p, 7 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 983, No 2, p 364-365, June 12, 1979.

Descriptors: *Patents, *Oil pollution, *Oil wastes, *Waste water treatment, *Oil-water interfaces, Baffles, Separation techniques, Equipment, Settling tanks, Gravity separation

A settling tank structure for oil and water mixtures is described. It comprises an elongate tank having an inlet for the mixture on one end and a first outlet for water at the other end. The walls of the tank have a predetermined height for holding a predetermined quantity of the mixture for settling. The first outlet includes means for maintaining static liquid level in the tank at a predetermined height. The inlet is located near the top of the wall height, and the first outlet is located near the bottom of the wall. It also comprises a second outlet for oil located above the inlet near the top of the wall. Baffle means for maintaining piston-like displacement of the oil and water mixture are located from one end to the other. (Sinha-OEIS)
W80-01183

METHOD AND APPARATUS FOR EXTRACTING WASTE MATERIAL,
AB Kalle-Regulatorer (Sweden). (Assignee).
G. I. Ingemarsson.
U.S. Patent No 4,158,627, 5 p, 1 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 983, No 3, p 594, June 19, 1979.

Descriptors: *Patents, *Waste water treatment, *Sludge treatment, Sewage treatment, Drainage, Flocculation, Settling basins, Sludge dewatering.

A method for treating sludge as part of wastewater treatment comprises discrete and noncontinuing steps of: adding flocculating agents to a quantity of sludge and stirring the mixture; feeding the stirred mixture into a basin having a perforated bottom

and upon a first perforated web to allow water to drain; moving the web and hence the deposited residue to a location out of the basin to a pair of linear plates; and pressing the plates together to squeeze water from the residue between the plates. (Sinha-OEIS)
W80-01185

PROCESS AND SYSTEM FOR CONTROLLING AN ORBITAL SYSTEM,
Envirotech Corp., Menlo Park, CA. (Assignee).
R. W. Okey.
U.S. Patent No 4,159,243, 7 p, 8 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 811, June 26, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Nitrification, *Denitrification, Aeration, Oxygen, Control systems, Equipment, Orbital system.

The orbital system operates to accomplish nitrification and denitrification and includes a control system to control the extent to which nitrification and denitrification take place. However, the control system is unable to operate effectively if the characteristics of the sewage fluctuate substantially. An object of this invention is to provide a process and a system to control the operation of an orbital sewage treatment system, the control process and system being capable of effective operation over a wide range of sewage characteristics. (Sinha-OEIS)
W80-01188

METHOD AND APPARATUS FOR TREATING METAL CONTAINING WASTE WATER,
Gotzelmann KG Industrieabwasser-Anlagen, Stuttgart (Germany, F.R.).
R. Kammel, and H-W. Lieber.
U.S. Patent No 4,159,235, 9 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 808, June 26, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, *Metals, Electrolysis, Cathods, Anodes, Flow, Movement, Equipment, Product recovery.

A method for treating metal containing waste water employes a vessel containing the waste water in which there is provided at least one anode and a cathode consisting essentially of electrically conductive particles. The waste water is subjected to electrolysis during which the waste water and the particles of the cathode are being moved. The particles of the cathode are arranged in a cage closed on all sides whose walls are perforated. The cage is moved by an external force during the electrolysis in order to move the particles. The waste water is simultaneously moved by producing a forced flow through the particles. Movement of the electrodes can be realized by vibration, and the relative movement of the particles in conjunction with the forced flow of the waste water produces particularly favorable deposition conditions for metals. (Sinha-OEIS)
W80-01189

REMOVAL OF FLUORINE FROM WATER,
Kohei Deguchi (Japan). (Assignee).
M. Matsumoto.
U.S. Patent No 4,159,246, 6 p, 4 Fig, 5 Tab, 7 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 812, June 26, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Separation techniques, Fluorine, Chemical reactions, Electrolysis, Aluminium.

A method for removal of fluorine from water comprises putting aluminium sulfate or aluminium chloride and sodium aluminate into a treating water, and stirring the solution while adjusting the pH value in the range of 6.6 to 6.9, and removing the aluminium fluorides produced, thereby reducing the fluorine content to 5 ppm or below. A further aspect of the invention comprises installing an anode of aluminium against a cathode of copper or iron in a treating water, passing a d.c. current through it to ionize aluminium ions, adding aluminium sulfate or aluminium chloride and sodium aluminate to the treating water, and stirring the solution while adjusting the pH value in the range of 6.0 to 7.0 to produce aluminium fluoride hydrates and causing the aluminium fluoride hydrates to be adsorbed in flocks of aluminium hydroxides. (Sinha - OEIS)
W80-01190

CATCH BASIN PROCESSING APPARATUS,
LRS Research, Ltd., Broomall, PA. (Assignee).
L. P. Taylor, and A. Petroski.
U.S. Patent No 4,159,248, 13 p, 3 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 813, June 26, 1979.

Descriptors: *Patents, *Waste water treatment, *Sludge treatment, Settling basins, Dewatering, Landfills, Recycling.

A mobile system for cleaning and processing catch basin and/or lagoon waste products is described wherein the degree of waste product dilution is carefully controlled prior to transmission to a mobile dewatering truck. The truck comprises dewatering apparatus which is controlled to produce a substantially dry land fill suitable end product and water suitable for recirculation or environmentally acceptable discharge to a process head or sanitary sewer. (Sinha - OEIS)
W80-01191

5E. Ultimate Disposal Of Wastes

LABORATORY INVESTIGATION OF THE DYNAMICS OF MUD FLOWS GENERATED BY OPEN-WATER PIPELINE DISPOSAL OPERATIONS,
JBF Scientific Corp., Wilmington, MA.
G. Henry, R. W. Neal, and S. H. Greene.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 488, Price codes: A08 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-46, August 1978. 155 p, 46 Fig, 5 Tab, 19 Ref, 3 Append.

Descriptors: *Pipelines, *Mud, *Mudflows, *Slurries, Laboratory tests, *Dredged material, *Dredged material disposal.

A laboratory study was made of the fluid mud system originating at the discharge point of open-water pipeline disposal operations. The objective was to define the dynamics of the mud system and to quantify the primary variables that control its behavior. These variables included salt content of the sediment, slurry solids concentration, bottom slope, slurry flow rate, water current, and surface waves. The fluid mud system was characterized by head wave velocity, cloud height, fluid mud layer thickness, concentration profiles, and bottom sediment deposition. Settling played an important role in the mud system dynamics. When settling was present, the head wave and mud flow slowed down and eventually stopped. In its absence, the mud system sustained its motion. Slurry flow rate and solids concentration influenced the mud system in accordance with the constant densimetric Froude number relationship. The fresh and saltwater systems did not revealevidence of flocculation. Bottom slope indicated the strongest control over the dynamics of the mud system. A minimum downslope angle of 0.75 deg (slope 1:76) was required for the flow to sustain itself. Water current generated more turbidity in the water column; these suspended solids were transported in the direction of the current. (WES)
W80-00911

PREDICTION OF VOLUMETRIC REQUIREMENTS FOR DREDGED MATERIAL CONTAINMENT AREAS,
Oklahoma State Univ., Stillwater.
M. L. Hayden.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 481, Price codes: A19 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-41, August 1978. 432 p, 123 Fig, 13 Tab, 38 Ref, 6 Append.

Descriptors: *Volume, *Forecasting, *Dredged material, *Dredged material disposal, *Volumetric requirements.

Results are presented of a study undertaken to determine the volumetric requirements of a confined disposal site filled with fine-grained dredged material. The method of study required a three-phase approach. The first phase was the evaluation of previous work and the formulation of a new prediction methodology based on modified consolidation theory and standard weight-volume relationships used in geotechnical engineering. The second phase consisted of developing the proposed prediction methodology. The final phase consisted of correlating the volume increase predicted by the proposed methodology with the rate of volume increase measured under field conditions. Also a computer program was created based on the prediction methodology developed during the study. The computer program was developed for the purpose of evaluating the effect of various input variables on the gain in available storage volume. Since the program was designed for applicability over a large range of conditions, the results obtained from the computer program are site-specific. The objective of this study was accomplished by evaluating the interrelationship of the various variables and their effect on the change in potential storage volume with time. (WES)
W80-00912

EVALUATION OF THE SUBMERGED DISCHARGE OF DREDGED MATERIAL SLURRY DURING PIPELINE DREDGE OPERATIONS,
JBF Scientific Corp., Wilmington, MA.
R. W. Neal, G. Henry, and S. H. Greene.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 612, Price codes: A11 in paper copy, A01 in microfiche. U.S. Army Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-44, August 1978. 232 p, 61 Fig, 8 Tab, 6 Ref, 2 Append.

Descriptors: *Dredging, *Pipelines, *Turbidity, *Dredged material, *Dredged material disposal.

Investigates the feasibility of using submerged discharge to control turbidity generated when a pipeline dredge discharges fine-grained dredged material slurry into open water. Program included a survey of field practices, literature survey, analytical investigations, and numerous flume tests. The investigation was performed at reduced scale in a specially constructed 8-ft-wide by 32-ft-long by 2.5-ft-deep test tank. Two series of tests were run: one in which a simple open pipe discharged dredged material slurry underwater and a second in which four different types of discharge processors, designed to reduce the discharge momentum, were tested and evaluated by comparing their performance with the open pipe. The influence of the following system parameters was examined: water type; sediment type; bottom type; solids concentration; and discharge velocity, angle, diameter or area, and height above the bottom. Results demonstrated that striking reductions in turbidity can be realized with a submerged discharge processor that diffuses the flow, minimizes entrainment, and discharges the dredged material slurry close to the bottom. The proposed design incorporates a conventional conical diffuser and a radial discharge section. Appendix A presents survey results of Corps of Engineers and private dredge operators who have been involved in open-water discharge. (WES)
W80-00913

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, NOTT ISLAND UPLAND HABITAT DEVELOPMENT SITE, CONNECTICUT RIVER, CONNECTICUT; APPENDIX C: POST-

PROPAGATION MONITORING OF VEGETATION AND WILDLIFE,
Connecticut Coll., New London.
W. J. Barry, J. L. Tabachnick, R. S. Warren, A. C. Carroll, and W. A. Niering.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A059 725, Price codes: A06 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-25, August 1978. 104 p, 19 Fig, 32 Tab, 26 Ref, 4 Append.

Descriptors: *Wildlife habitats, *Habitats, *Monitoring, *Connecticut River, *Dredged material disposal, *Disposal areas, *Habitat development, *Nott Island.

A 3.2-ha diked dredged material disposal site was constructed in 1975 on Nott Island in the Connecticut River, 11 km upriver from Long Island Sound. It was filled with sandy dredged material, top-dressed with finer sediments, and experimentally treated and planted with legumes and grasses. Monitoring of the planted vegetation and wildlife response to the vegetation during the 1977 growing season is reported. (WES)
W80-00914

DEVELOPMENT AND APPLICATION OF DESIGN AND OPERATION PROCEDURES FOR COAGULATION OF DREDGED MATERIAL SLURRY AND CONTAINMENT AREA EFFLUENT,
Jones, Edmunds and Associates, Inc., Gainesville, FL. and Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. H. Jones, R. R. Williams, and T. K. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 060, Price codes: A08 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MI. Tech. Report D-78-54, Sept. 1978. 170 p, 19 Fig, 17 Tab, 13 Ref, 2 Append.

Descriptors: *Coagulation, *Slurries, *Flocculation, *Dredged material, *Dredged material disposal, *Containment areas.

Guidelines are developed for the design of facilities to coagulate the overflow from a dredged material containment area. Pilot plant studies were conducted to study the efficiency of polyelectrolyte coagulation of overflow from a dredged material containment area at an active freshwater dredging site. Full-scale studies were conducted at the same site on the feasibility of coagulating dredged material by injecting polyelectrolytes into a hydraulic dredge pipeline. Results of the pilot plant studies showed that, under the conditions tested, polyelectrolytes could be highly effective for coagulation of dredged material. Laboratory procedures were developed that can lead to the selection of the most effective coagulant, the optimum coagulant dosage, and the design parameters for a coagulation system. Examples are provided to illustrate procedures required to design a coagulation system for a containment area overflow. Results of full-scale tests on the injection of polyelectrolytes into a hydraulic dredge pipeline were highly variable. High mixing rates and variability of composition of dredged material and flow rates caused a wide variation in treatment efficiency. Design examples are provided for the design of polyelectrolyte feed systems to inject polymer into a hydraulic dredge pipeline. (WES)
W80-00918

FIELD DEMONSTRATION OF SHRIMP MARICULTURE FEASIBILITY IN DREDGED MATERIAL CONTAINMENT AREAS,
Dow Chemical U. S. A., Freeport, TX. Texas Div.
J. A. Quick, Jr., R. J. Hover, D. J. Milligan, W. F. McIlhenny, and S. E. Hill.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 652, Price codes: A07 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-53, August 1978. 139 p, 52 Fig, 4 Tab, 80 Ref, 1 append.

Descriptors: *Shrimp, *Dredged material, *Dredged material disposal, *Waste disposal sites, *Containment areas.

The potential of shrimp mariculture in dredged material containment areas (dmca's) as a productive use of those sites is examined. A 158-acre dmca located on the Gulf Intracoastal Waterway near Freeport, Texas was the demonstration site. A manageable 20-acre pond area was isolated from the main containment area by an internal levee and used as the culture pond. The pond was filled with 50-micron-screened seawater pumped from the Intracoastal Waterway. To kill any predators present in the water, the pond was treated with an icthyotoxin. Commercial agriculture fertilizer was added to the pond to stimulate a phytoplankton bloom which served as the sole food supply for the shrimp. No prepared food was provided to the shrimp during the experimental grow-out. The pond was stocked with 30-day-old 'hardened' postlarval penaeid shrimp (Penaeus setiferus). Seven weeks later, average survival was estimated to be in the range of 86 to 93 percent and the average size of the shrimp sampled was 5.2 gm. (87 count, heads on). The harvest rate was estimated to average 185 to 200 pounds per acre. It is concluded that it is biologically and economically feasible to culture penaeid shrimp on a commercial scale in dmca's. (WES)
W80-00919

SUPPLYING WATER TABLE INTAKE THROUGH AGRICULTURAL USE OF URBAN SEWAGE,
Institute of Land Improvement in Green Lands, Wroclaw (Poland).
J. Wierzbicki.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 304, Price code; A02 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Draft Translation 652, 1977, 1 Fig, 2 Ref, Translated from Gaz woda i technika sanitarna, Vol 31, No 1, p 17-18. 1957.

Descriptors: *Groundwater, *Sewage disposal, *Water table, *Artificial recharge, *Water supply, *Bielefeld(Poland), Poland, Groundwater recharge, Sewage, Land use, Waste water(Pollution), Waste water disposal, Irrigation, Land resources, Percolation, Urban hydrology, Drawdown, Water level fluctuations, Water levels, Sludge disposal, Agriculture.

Water table and surface water levels rose considerably and fallow land was transformed into lands with sewage water from urban areas, near Bielefeld, Poland, in 1951-1956. Bielefeld, a city of 170,000, uses groundwater as its major water supply; however in 1952, water table and area stream levels began to drop alarmingly with water supply demands of seven million cu m/yr. Forests and agricultural lands also began to show groundwater reduction effects. Urban sewage water now meets groundwater supplies quantitatively. Sewage percolation at low load conditions of 60-70 mm/month also guarantees good water quality. A tunnel and pipeline was built in 1953, conducting sewage by gravity to irrigate 620 ha fields. Conduits were 23 km long and total costs were 8.6 million German marks. In 1954, five million cu m of initially treated sewage was pumped into neighboring streams; sewage was sprayed onto plowed fields. Fields soil was diluvial sand, 20-25 km deep; filtration rate averaged one m/d. After 1956, land irrigated with sewage water was transformed to arable lands and water levels in streams and waterworks supplies rose. Streams continued to carry pure water. (Danovich-Wisconsin)
W80-00987

INTEGRATION OF THERMAL AND FOOD PROCESSING RESIDUALS INTO A SYSTEM FOR COMMERCIAL CULTURE OF FRESHWATER SHRIMP (POWER PLANT WASTE HEAT UTILIZATION IN AQUACULTURE). VOLUME 3,
Rutgers - The State Univ., NJ. Dept. of Physiology.
A. Farmanfarmian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 870, Price codes: A07 in paper copy, A01 in microfiche. January 1977. 129 p, 20 Fig, 23 Tab, 87 Ref. AEN 7414079 A01 GI 43925.

Descriptors: *Heated water, *Electric power plants, *Aquiculture, *Trout, *Shrimp, Effluents, Foods, Food processing industry, New Jersey, Waste water(Pollution), Metabolism, Growth rates, Fish, Water temperature, Heavy metals, Toxicity, Coals.

Metabolism, short-term survival, growth, or conversion efficiency of shrimp and trout are not affected by acute or chronic exposure to power plant intake and discharge water; effluent with or without coal particles, or effluent with or without slurry overflow mix. This study examines commercial cultures of freshwater shrimp, Macrobrachium rosenbergii, and rainbow trout, Salmo gairdneri, in thermal discharges of the Mercer power plant, Trenton, N.J. Shrimp tissues directly exposed to coal particles for three months reveal no accumulation in gills, muscle, and gastrointestinal tissues; however, stomach and intestines accumulate coal particles. Chlorine, used as a biocide in once-through cooling water, has deleterious effects on all measured responses. Shrimp survive a 48 h exposure to 0.5 ppm total available chlorine, but 100% mortality occurs within seven h of a one ppm chlorine exposure. Trout survive four h exposure to 0.5 ppm total available chlorine; 100% mortality occurs in 10.5h. Both species are affected by raised mercury levels, which occur near coal burning power plants. Trout in Mercer ponds normally contain less than 0.002 ppm mercury in fresh muscle. At 0.5 ppm mercury exposures, mortality results over 10 d, fresh tissues accumulate 2.2 to nine ppm. Shrimp exposed to 0.25 ppm mercury experience 100% mortality in 6.1 d. Critical temperature maximum and minimum and lethal temperature maximum and minimum as well as dissolved oxygen and diet supplements are evaluated for growth and food conversion ratios. (Danovich-Wisconsin)
W80-01135

5F. Water Treatment and Quality Alteration

DEVICE FOR REGULATING DRINKING WATER,
Kabushikigaisha OMOCO, Saitama (Japan). (Assignee)
T. Okazaki.
U.S. Patent No 4,152,238, 15 p, 15 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 211, May 1, 1979.

Descriptors: *Patents, *Water treatment, *Water softening, Water purification, Water quality control, Electrolysis, Electrodes, Temperature, Equipment.

A device for softening and increasing the pH of drinking water comprises an electrolyzer vessel for receiving water; an unglazed partition member dividing the vessel into a negative electrode chamber and a positive electrode chamber; and positive and negative electrodes. The electrodes are energized by direct current for a prescribed period of time to separate water in the electrolyzer into two components having a hydroxyl radical in different densities by electrolysis and electroendosmose. The negative electrode has a hollow space for a heating element to warm the water body during the electrolysis to improving the softening of the water. A temperature sensitive means is electrically coupled to the heating element to control the temperature of the water and to avoid overheating of the negative electrode. (Sinha - OEIS)
W80-00877

FILTRATION AND PURIFICATION APPARATUS,
J. G. Rose.
U.S. Patent No 4,152,262, 7 p, 10 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 219, May 1, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Filtering, Mixing, Domestic water, Industrial water, Equipment, Iodine.

A filtration and purification apparatus is used in water lines of both domestic and industrial applications where water must be purified and filtered prior to use--particularly with respect to human consumption. A housing has an inlet port and an outlet port which can be connected directly into a water system or connected to a water-system-outlet faucet and is thus a portable water filter/purifier unit. The inlet allows water to enter the filtering chamber by way of a check valve. The water passes through the filter member and then discharges into a metering compartment which is also provided with a check valve. The metering compartment is connected to both a mixing compartment and a purifying chamber, so that filtered water is directed from the metering compartment into both the purifying chamber and the mixing chamber. The purifying chamber includes a predetermined amount of iodine crystals. The controlled and mixed amount of water is discharged from the mixing chamber through the outlet of the housing for use. (Sinha - OEIS)
W80-00879

FILTER FOR TREATMENT OF NATURAL AND WASTE WATER,
Leningrad Communal Agriculture Academy Research Inst. (USSR).
For primary bibliographic entry see Field 5D.
W80-00881

USE OF ACIDIFIED COPPER SULFATE IN HYDROGEN SULFIDE REMOVAL,
J. O. McLean.
U.S. Patent No 4,153,547, 4 p, 1 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 650, May 8, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Wells, Odor, Sulfur, Filtration, Neutralization, Copper sulfate, Equipment, Filters, Backwashing.

A method of treating well water for purposes of desulfurizing the well water and making it palatable is described. The water is treated with an excess of acidified copper sulfate or other metal salt and delivered into the top of a treating tank which contains a neutralizing filter means. Copper sulfide is precipitated from the water and removed in the filter tank whereby sulfur-free neutral water is obtained. Any excess copper sulfate is precipitated as copper hydroxide and also removed in the filter. Periodically, the filter tank automatically backwashes itself to remove the copper residues or the filter may be manually backwashed if desired. (Sinha-OEIS)
W80-00885

METHOD AND APPARATUS FOR CONDITIONING DEMINERALIZED WATER,
UOP Inc., Des Plaines, IL. (Assignee).
A. B. Riedinger.
U.S. Patent No 4,153,556, 4 p, 2 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 653, May 8, 1979.

Descriptors: *Patents, *Water treatment, *Water softening, Demineralization, Scaling, Hardness(Water), Carbon dioxide, Hydrogen ion concentration, Limestones, Equipment.

When brackish water or sea water is demineralized, the feed stream generally requires pH adjustment. For storage and distribution the water must be conditioned or 'stabilized' by reducing the CO2 and additionally raising the pH to approximately 8. The concept of the invention is applicable to the product water from all demineralization devices where pH adjustment has been utilized to prevent calcium carbonate scaling. The purified water is fed through a wide-angle low pressure spray nozzle onto a conical surface where it films out at a relatively slow rate releasing the bulk of the free CO2. The stream then travels down a center tube and up through a bed. The material in the bed is preferably limestone chips. The bed diameter and height are so chosen that the water residence time is at least two minutes, to insure reaction. This will convert the remaining CO2 to bicarbonate while dissolving an additional amount (a few ppm of calcium carbonate) and converting it to bicarbonate. Properly sized, the pH cannot go above 8 and there will be little if any free CO2. (Sinha-OEIS)
W80-00887

KETTLE DISTILLING UNIT,
W. Andrei.
U.S. Patent No 4,156,631, 6 p, 7 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1687-1688, May 29, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, Water pollution treatment, Distillation, Water quality control, Condensation, Domestic water, Equipment.

The invention provides a relatively inexpensive simple distillation unit which can be used with a source of boiling water such as a kettle which may be heated electrically or otherwise as desired. The kettle includes a spout through which steam is discharged and a source of circulating cooling water is provided. The unit comprises an enclosure with means to support the enclosure and also extends upwardly above the associated spout of the kettle. Seam entry means are provided at the base of the enclosure for receiving steam from the spout and the upper end of the enclosure is closed. A condensing coil is supported within the enclosure and means are provided to operatively connect the condensing coil to the source of circulating cooling water. Means are provided to collect condensate from the condensing coil at the base of the enclosure and to discharge it. A feed from the heated cooling water replenishes the water supply in the kettle and may be automatic if desired. (Sinha - OEIS)
W80-00907

FLOTATION DEVICE WITH PRETREATMENT,
Office of the Secretary of the (Navy), Washington, DC.
For primary bibliographic entry see Field 5D.
W80-00910

CHEMICAL, PHYSICAL, AND RADIOLOGICAL QUALITY OF SELECTED PUBLIC WATER SUPPLIES IN FLORIDA, NOVEMBER 1977-FEBRUARY 1978,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. A. Irwin, and R. W. Hull.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 829, Price codes: A08 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-50, 1979. 169 p, 6 Fig, 8 Tab, 12 Ref.

Descriptors: *Florida, *Potable water, *Water quality, *Water supply, *Water treatment, Water quality standards, Water analysis, Chemical analysis, Surface waters, Groundwater, *National Interim Primary and Proposed secondary drinking water regulations.

Virtually all treated public water supplies sampled in Florida meet the National Interim Primary and Proposed Secondary Drinking Water Regulations. These findings are based on a water-quality reconnaissance of 129 treated public supplies throughout the State during the period November 1977 through February 1978. While primary drinking water regulation exceedences were infrequent, lead, selenium, and gross alpha radioactivity in a very few water supplies were above established maximum contaminant levels. Additionally, the secondary drinking water regulation parameters--dissolved solids, chloride, sulfate, iron, color, and pH--were occasionally detected in excess of the proposed Federal regulations. The secondary regulations, however, pertain mainly to the aesthetic quality of drinking water and not directly to public health aspects. (Woodard-USGS)
W80-00929

A STUDY OF THE IN-SITU INDIRECT FREEZING PROCESS,
New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
For primary bibliographic entry see Field 3A.
W80-01006

A STUDY OF THE VACUUM-FREEZING HIGH PRESSURE ICE-MELTING PROCESS,
New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.
For primary bibliographic entry see Field 3A.
W80-01007

5G. Water Quality Control

THE RELATIONSHIP BETWEEN WATER DEPTH AND SEDIMENTARY PIGMENT CONCENTRATION IN TWO HOLOMICTIC BERKSHIRE LAKES,
Massachusetts Univ., Amherst. Dept. of Zoology.
S. D. Ludlam.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-108590, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, Univ. of Massachusetts/Amherst Publication No 105, 1979. 30 p, 6 Fig, 2 Tab, 27 Ref. OWRT A-109-MASS (1), 14-34-0001-8023.

Descriptors: *Paleolimnology, *Chlorophyll, *Eutrophication, *Sediments, *Ponds, *Lakes, Massachusetts, *Berkshire lakes, *Chlorophyll derivatives.

The concentration of chlorophyll derivatives and total carotenoids in the sediment of lakes studied to date is directly related to the depth of water overlying the sediment. This relationship is roughly linear until relatively deep water is reached where there is a tendency for sedimentary pigment concentration to increase more slowly or remain relatively stable with further increases in water depth. In each of two holomictic lakes, pigment profiles taken from all water depths below and including the littoriprofundal zone were similar in their major features, despite the influence of water depth on overall pigment concentration. The relationship between water depth and sedimentary pigment concentration is probably indirect. Although several explanations are possible it seems most probable that water depth controls turbulence and hence resuspension of the sediment. Sedimentary pigments are subject to degradation during resuspension. Thus, the least amount of degradation and, therefore, the greatest concentration of pigments are expected in deep water. If this explanation is correct, pigment profiles and pigment concentrations will reflect morphometry as well as fluctuating climate and water levels. For this reason caution is urged in interpreting pigment profiles, particularly in sediment deposited prior to historical records. (Godfrey-Mass)
W80-00871

MATERIAL RECOVERY APPARATUS,
Oil Mop Ltd., Christchurch (England).
R. T. Challener.
U.S. Patent No. 4,146,477, 8 p, 4 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 980, No 4, p 1414-1415, March 27, 1979.

Descriptors: *Patents, *Water pollution treatment, *Water quality control, *Oil pollution, Skimming, Adsorption, Equipment, Floating adsorbent rope.

A buoyant rope which has the property of preferentially adsorbing oil in relation to water is formed as a continuous loop which floats on the water between a desorption station where it is advanced through an oil desorption means and a rope-guide station remote from the desorption station where the run of the loop is guided around a guide pulley and through the desorption unit, the oil being removed from the incoming run of the rope to produce a continuously cleaned return run for a

further advance over the oil contaminated water. The rope guide structure is so constructed so that under the pull of the rope during relative movement between the desorption station and the liquid the rope is brought into a disposition in which at least part of the length of it has a component of motion over the surface of the water. The rope guide structure includes steering means responsive to deviations in the tension of the rope from a predetermined tension so to steer the rope guide structure as to maintain or tend to maintain the tension of the rope at the predetermined tension. (Sinha-OEIS)
W80-00872

METHOD FOR THE DISTILLATION OF SEA WATER,
Hitachi, Ltd., Tokyo (Japan).
For primary bibliographic entry see Field 3A.
W80-00875

BAR SCREEN,
M. Hori.
U.S. Patent No 4,153,557, 3 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 982, No 2, p 653, May 8, 1979.

Descriptors: *Patents, *Water pollution treatment, *Water quality control, Screens, Running waters, Pollutants, Water pollution, Equipment.

An improved bar screen installed in flowing water to remove any rubbish is described. A bar screen is known which includes equally spaced parallel ring bars with scrapers arranged to scrape any rubbish from between the ring bars. Such a bar screen needs frequent cleaning to remove any rubbish caught between the scrapers and the ring bars and between the scrapers themselves. The object of this invention is to provide an improved bar screen which has scrapers that are easy to reset after cleaning. (Sinha-OEIS)
W80-00888

TWO-STAGE OIL-SEPARATOR,
Timmer (Henry), Grand Rapids, MI. (Assignee).
H. Timmer, and L. V. Slikkers.
U.S. Patent No 4,154,683, 9 p, 8 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1029-1030, May 15, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, Water quality control, Separation techniques, Equipment, Endless belts, Oil recovery.

A machine for separating an oil film from a supporting liquid elevates the oil from its original position with an endless belt, and then transfers the oil from the belt to a rotating disc from which it is wiped into a drainage trough. The belt system is driven from the disc, and is constructed as an attachment to a self-contained disc machine capable of functioning without the belt system when the disc can intersect the surface of the liquid. The unit is thus adaptable to installations where the liquid level is far below the rim of the accumulating tank where the machine is mounted, and where there is substantial variation in the liquid level. (Sinha-OEIS)
W80-00897

APPARATUS TO FACILITATE BURNING OF A LAYER OF OIL, PARTICULARLY OIL SPILLS,
R. D. Tokarz.
U.S. Patent No 4,154,684, 5 p, 6 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 1030, May 15, 1979.

Descriptors: *Patents, *Oil spills, *Oil pollution, *Water pollution treatment, Water quality control, Burning, Heat transfer, Equipment, Thermal insulation.

An apparatus for facilitating the burning of an oil spill in situ is described which utilizes closely associated floating facilitators. The facilitators are constructed of a highly insulative and porous material for subdividing the oil spill into separably definable oil columns that are substantially thermally insulated from the body of water to minimize heat transfer between the body of water and the oil spill. (Sinha-OEIS)
W80-00898

KETTLE DISTILLING UNIT,
For primary bibliographic entry see Field 5F.
W80-00907

DUAL-PURPOSE DETENTION BASINS,
Rutgers - The State Univ., New Brunswick, NJ Water Resources Research Inst.
W. Whipple Jr.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 105, No WR2, Proceedings Paper 14860, p 403-412, September 1979. 3 Fig, 32 Ref, 1 Append.

Descriptors: *Flood control, *Water quality control, *Basins, *Urbanization, Urban runoff, Water pollution, Water quality, Sediments, Sediment control, Multiple-purpose projects, Multiple-purpose reservoirs, Runoff, Urban runoff, Dams, Reservoirs, Design, Hydrology, Detention basins, Dual-purpose detention basins

Design criteria for small detention basins, which are being built in large numbers to reduce flooding in rapidly urbanizing areas, may be modified to serve additionally the purpose of reducing runoff pollution, which also accompanies urbanization. Only slight reduction in local flood-control effectiveness will be entailed by the modification, and the dual-purpose basins will be more useful in aid of flood control further downstream than the single purpose locally oriented structures. Runoff pollution from urbanizing areas is important to water quality planning and occurs largely in particulate form. However, the trap effectiveness of detention basins for different kinds of pollutants, retained in storage for various periods, has not yet been determined by research or practical experience; so that design criteria for dual-purpose detention basins cannot be stated with any degree of precision. (Sims-ISWS)
W80-00975

STATISTICAL EVALUATION OF SAMPLING FREQUENCIES IN MONITORING NETWORKS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 7A.
W80-00976

ANALYSIS OF WATER RESOURCES REQUIREMENT FOR THE ENHANCED (TERTIARY) OIL RECOVERY IN THE SOUTHERN PLAINS REGION OF THE UNITED STATES,
Texas Univ. at San Antonio. Div. of Environmental Studies.
Chia Shun Shih, and H. Hamilton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110869, Price codes: A10 in paper copy, A01 in microfiche. Technical Completion Report, September 1979, 207 p, 28 Fig, 33 Ref. OWRT B-218-TEX (1). 14-34-00018120.

Descriptors: *Water requirements, *Available water, *Water quality, *Oil industry, *Oil recovery, Southern Plains Region(US), Texas, Oklahoma, New Mexico, Louisiana.

This report analyzes the water esources requirements, in terms of both water quantity and quality, for the anticipated enhanced oil recovery operations to be implemented in the Southern Plains region of the United States. The enhanced oil recovery potential of each oil-producting reservoir in the four states of Texas, Oklahoma, New Mexico, and Louisiana is assessed using parameters describing the basic characteristics of crude oil and the reservoir formation. The water resources, including the surface water and groundwater resources will be delineated by producing subregions. An analysis has been performed to determine the incremental water demand and water quality requirements for enhanced oil recovery operations based on overall domestic, agricultural, and industrial demands versus water resources available. Potential enhanced oil recovery productions associated with alternative pricing scenarios are used in the assessment of water resources constraining effects. The water quality impacts of enhanced recovery methods are assessed considering surface water pollution by discharged chemicals and waste waters, groundwater pollution by the fracture of well casings, and infiltration of chemicals and oil/water mixtures.
W80-01005

IMPACT OF THE ARGO MERCHANT OIL SPILL ON MACROBENTHIC AND PELAGIC ORGANISMS,
Food and Agriculture Organization of the United States, Rome (Italy)
For primary bibliographic entry see Field 5C.
W80-01145

OIL SPILL BEHAVIOR IN ICE DURING THE 1977 BUZZARDS BAY OIL SPILL,
For primary bibliographic entry see Field 5C.
W80-01146

WEATHERING ESTIMATIONS FOR SPILLED OIL FROM BOUCHARD NO 65,
NOAA National Analytical Facility, Seattle, WA.
For primary bibliographic entry see Field 5C.
W80-01147

PHYSICAL ASPECTS OF THE OIL SPILL FROM THE SUPERTANKER 'METULA',
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 5C.
W80-01150

THE IMPACT OF THE SANSINENA EXPLOSION AND BUNKER C SPILL ON THE MARINE ENVIRONMENT,
University of Southern California, Los Angeles. Inst. for Marine and Coastal Studies.
For primary bibliographic entry see Field 5C.
W80-01152

THE FATE AND WEATHERING OF SURFACE OIL FROM THE BRAVO BLOWOUT,
Continental Shelf Inst., Trondheim (Norway).
For primary bibliographic entry see Field 5C
W80-01153

PROFILING WATER QUALITY SENSING SYSTEM,
General Dynamics, San Diego, CA. Electronics Div.
J. H. Hinchman.
U.S. Patent No 4,157,657, 14 p, 13 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 983, No 2, p 262, June 12, 1979.

Descriptors: *Patents, *Water quality control, *Testing, Water analysis, On-site tests, Profiles, Instruments, Equipment, Electronic equipment, Sensing, Sensors.

A system for obtaining a vertical profile of water quality in a body of water is disclosed. The system includes a sensor for sensing predetermined characteristics of water and the depth of water at which the predetermined characteristics are sensed, a cable attached to the sensor for holding the sensor, and a winch assembly attached to the cable for deploying and retrieving the cable and the sensor. The winch assembly includes a nonventilated DC motor coupled to the drum for driving the drum to retrieve the cable, and for generating electricity during deployment of the cable in response to the torque on the motor created by the cable and the sensor during deployment, an electromagnetically released brake coupled to the motor for braking the motor when the brake is not energized, a battery for providing energy for the motor and the brake, and a motor

controller coupled to the battery for providing constant voltage excitation of the motor and for controlling the brake. The motor controller includes a circuit which inhibits the motor from operating as a motor during deployment of the cable, and a circuit for reversing the polarity of the motor to cause the motor to generate electricity for recharging the battery during deployment of the cable. A control circuit is coupled to the sensor and to the motor controller for causing the motor controller to brake and stop the motor in response to sensing a predetermined depth of water. (Sinha-OEIS)
W80-01179

SENSOR DEVICE FOR WATER SOFTENER SYSTEM,
A. J. Fleckensteim.
U.S. Patent No 4,158,628, 5 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 983, No 3, p 595, June 19, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, *Water softening, Ion exchange, Calcium, Sodium, Electric currents, Regeneration, Sensors.

This invention provides a sensor device that is direct acting in response to the calcium/sodium state of the ion exchange material in which it is fully immersed and having full flowing contact with the water in the treatment tank so that it is fully responsive to such state immediately, as changes occur. The sensor is tubular and the sensor element comprises a tube of ion exchange material which reacts to the state of the ion exchange material in the treatment tank by expanding and contracting according to the calcium or sodium state of the tube. The device incorporates electrical contacts and when the tube is expanded the contacts are open and when the tube is contracted the contacts are closed to complete an electrical circuit. When the ion exchange material in the tank has been regenerated it is in the sodium state and the material of the tube as well, so that it is expanded and the contacts are open to open the electrical circuit. When the ion exchange material in the tank is depleted both the material of the tank and that of the tube are in the calcium state so that the contracts in the sensor are closed to complete the electrical circuit. (Sinha-OEIS)
W80-01186

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

SOLUTION OF LARGE SCALE PIPE NETWORKS BY IMPROVED MATHEMATICAL APPROACHES,
Southern Methodist Univ., Dallas, TX. School of Engineering and Applied Science.
M. A. Collins, L. Cooper, R. V. Helgason, and J. L. Kennington.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-106651, Price codes: A08 in paper copy, A01 in microfiche. Technical Completion Report IEOR 77016-WR77001, August 1978, 155 p, 14 Fig, 19 Tab, 108 Ref, 3 Append. OWRT C-7115 (No 6223) (2), 14-34-0001-6223.

Descriptors: *Networks, *Pipe networks, *Water distribution(Applied), Open channel networks, Mathematical programming, Nonlinear networks, Nonlinear programming, Operations research, NETFLO, WATSIM, Hardy cross, Newton-Raphson, Linearization, PARTAN, Convex simplex, Piece-wise linear approximation, Content model, CoContent model, Frank-Wolfe algorithm.

The classical pipe network analysis problem is traditionally solved using iterative methods--Hardy Cross, Newton-Raphson, or linearization. Kuhn-Tucker theory is used to show that there exists two mathematical programming models whose solution is precisely the solution to the pipe network analysis problem. Three optimization algorithms--Frank-Wolfe, convex simplex, and piece-wise linear approximation--are used to solve four pipe network analysis problems using one of the mathematical programming models. Computational behavior is compared to that of a state of the art Newton-Raphson code. Computational experience with a network of 452 nodes and 530 elements is detailed. Numerical experiments clearly demonstrate that solution of the pipe network analysis problem using mathematical programming techniques is an attractive alternative to currently used iteration methods. Preliminary extension of the models is made to open channel networks. The models are also used to demonstrate the existence of, or lack of, solution uniqueness.
W80-00869

BASELINE WATER QUALITY OF IOWA'S COAL REGION,
Geological Survey, Iowa City, IA. Water Resources Div.
L. J. Slack.
Geological Survey open-file report 79-980, 1979. 74 p, 1 Fig, 7 Tab, 7 Ref.

Descriptors: *Baseline studies, *Water quality, *Streams, *Iowa, *Streamflow, Flow rates, Water analysis, Sampling, Chemical analysis, *Pre-coal mining, *South-Central Iowa, White Breast basin, English basin, Cedar basin.

To assist the Iowa Department of Environmental Quality in determining the effects that coal mining and attendant activities will have on the water quality of Iowa streams, the U.S. Geological Survey collected three sets of water-quality samples (representative of high, average, and low streamflow) in the White Breast, English,aand Cedar Creek basins in south-central Iowa. These samples were analyzed by the U.S. Geological Survey Central Laboratory at Denver, Colorado, and by the Iowa State Hygienic Laboratory (Iowa City and Des Moines). The report presents the data collected from May to November 1978 at 15 stations in the study area. (Woodard-USGS)
W80-00931

A DIGITAL MODEL FOR SIMULATION OF GROUND-WATER HYDROLOGY IN THE HOUSTON AREA, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
W. R. Meyer, and J. E. Carr.
Texas Department of Water Resources LP-103, August 1979. 133 p, 15 Fig, 36 Ref, 3 Append.

Descriptors: *Model studies, *Hydrogeology, *Computer models, *Aquifer characteristics, *Groundwater movement, Simulation analysis, Clays, Withdrawal, Transmissivity, Hydraulic conductivity, Leakage, Water storage, Water levels, Water table, Texas, *Houston area, *Chicot aquifer(TX), *Evangeline aquifer(TX), Finite-difference model.

This report documents the construction and calibration of a digital model for the simulation of hydrologic conditions in the Chicot and Evangeline aquifers in the Houston area of southeastern Texas. The model is a five-layer finite-difference model, with a grid pattern of 63 x 67 nodes representing an area of 27,000 square miles, for simulation of three-dimensional ground-water flow. The hydrologic properties and processes modeled were ground-water withdrawals, transmissivities, storage coefficients of the aquifers and clays, quantity of water derived from storage in the clays, and vertical hydraulic conductivity and vertical leakage. The model, which simulates water-level declines, changes in storage in the clay layers, and land-surface subsidence, was calibrated by use of historical records from 1890 to 1975. It is very sensitive to variations in transmissivities and to variations in water-table and artesian storage. It is less sensitive to variations in clay storage. (Woodard-USGS)
W80-00935

ASSESSMENT OF FITTING TECHNIQUES FOR THE LOG PEARSON TYPE 3 DISTRIBUTION USING MONTE CARLO SIMULATION,
Queen's Univ., Kingston (Ontario).
For primary bibliographic entry see Field 2E.
W80-00947

A CONCEPTUAL DETERMINISTIC ANALYSIS OF THE KRIGING TECHNIQUE IN HYDROLOGY,
IBM Scientific Center, Venice (Italy).
G. Gambolati, and G. Volpi.
Water Resources Research, Vol 15, No 3, p 625-629, June 1979. 1 Fig, 8 Ref.

Descriptors: *Data processing, *Forecasting, *Methodology, *Analytical techniques, Hydrologic data, Numerical analysis, Mathematics, Model studies, Analysis, *Kriging technique, *Interpolation methods, Predictive ability, Interpolation error, Main trend.

A stochastic approach to interpolating sparse observationrecords in hydrology, referred to as the 'kriging technique', has recently been developed. Distinct primary features of this method are supposed to be its predictive reliability and its ability to provide an estimation error. A deterministic analysis for the kriging technique indicated its close relationship with the most traditional interpolation schemes. The formulation showed that any claim to more accurate estimates than with other commonly used methods cannot be substantiated. However, a unique and distinct advantage of the kriging technique is its ability to provide an assessment of the interpolation error. An attempt also was made to give a deterministic interpretation for the main trend. The conclusions of the analyses made suggested that in practical applications, the interpolation model is not improved by the use of a main trend, unless its expression reflects some additional information related to the general hydrologic context but not included in the available observations. (Singh-ISWS)
W80-01028

MAR DEL PLATA ACTION PLAN,
In: Water Management and Development, Proceedings of the United Nations Water Conference; Mar del Plata, Argentina, March 1977. New York, 1978, Pergamon Press, Vol 1, Part 1, p 273-332.

Descriptors: *United Nations Water Conference, *Water management(Applied), *Water resources development, *International cooperation, *Water policy, Legislation, Adoption of practices, Regulation, Water distribution(Applied), Water demand, Forecasting, Municipal water, Waste disposal, Agriculture, Irrigation, Industrial water, Hydroelectric power, Inland waterways, Navigation, Public health, Water pollution control, Institutional constraints, Flood control, Droughts, Training, Research priorities.

Twenty-six general recommendations for action by the UN as a whole, by its regional agencies, and by member states, are agreed upon by the 1977 United Nations Water Conference. Recommendations cover: assessment of water resources, legislation for improved water use and efficiency, improved regulation and distribution of water resources measurement and projections of water demand, community water supply and waste disposal, agricultural water use, fisheries, industrial water use, hydroelectric power generation, inland navigation, water-related environment and health considerations, pollution control, national water policies, institutional arrangements, legislation, public participation, development of appropriate technologies, flood loss management drought loss management, education and training for water resources management, research needs, development of shared water resources, international cooperation, financing arrangements for water development, technical cooperation among developing countries. In addition to the general recommendations, regional recommendations are made for Africa, Europe, Latin America and Western Asia. (Harris-Wisconsin)
W80-01109

6B. Evaluation Process

URBANIZATION AND WATER QUALITY PLANNING: THE 208 EXPERIENCE IN MASSACHUSETTS,
Clark Univ., Worcester, MA. Dept. of Environmental Affairs.
H. E. Schwarz, B. B. Johnson, R. J. Caiazzo, and D. E. Pincus.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-106743, Pric codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center, Univ. of Massachusetts/Amherst Publication No 104, 1979. 135 p, 55 Tab, 9 Ref, 10 Append. OWRT-A-104-MASS (1), 14-34-0001-8023.

Descriptors: *Comprehensive planning, *Urbanization, *Water Resources Planning Act, Massachusetts, Water resources planning, Urban planning, *208 planning.

The initial premise of this study was that the degree of urbanization in an area would affect the scope of the planning process, public participation in planning, and the plan itself. Three measures of urbanization were used in this study: the percentage of the region in urban land use; the proportion of the population served by sewers; and the population density. Each of these was an independent variable in assessing the inter-regional variation of attributes of the 208 plans and of the 208 planning process. It was found that the degree of urbanization does not appear to have been a significant factor in the 208 planning process. Other findings about the 208 planning process were that each region had its own procedure of gathering and presenting data and recommendations, that plan contents were not consistent among regions, that regional funding did not seem to have been correlated with population size, land area, number of political entities, or water quality, and that plans did not recommend new management agencies nor make many specific or mandatory recommendations. In short, the 208 planning process in Massachusetts and the resulting plans were highly idiosyncratic, and tended to reflect town priorities rather than national pollution abatement goals. Doubts must be raised about its substantive accomplishments when measured against the objectives of the Clean Water Act.
W80-00870

MODELING RECREATION USE IN WATER-RELATED PARKS,
Regional Science Research Inst., Philadelphia, PA.
R. E. Coughlin, D. Berry, and P. Cohen.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A071 898, Price codes: A05 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report R-78-1, October 1978. 94 p, 6 Fig, 12 Tab, 26 Ref, 3 Append.

Descriptors: *Parks, *Recreation, *Model studies.

This report extends to nonreservoir parks the earlier work of the U. S. Army Corps of Engineers on the recreation use of reservoir parks. A thorough review of the literature was followed by a test of several models including those already completed by the U. S. Army Engineer District, Sacramento. For this test, data from New York State Parks were used. The results are somewhat weaker than those obtained by the Sacramento District. This is attributed, in part, to the fact that the data were collected for another purpose and did not contain as many observations as would be desirable for a spatial analysis of this type. (WES)
W80-00915

DEVELOPMENT OF IMPROVED DECISION-ORIENTED RECREATION USER INFORMATION SYSTEM,
Midwest Research Inst., Kansas City, MO.
R. M. Mischon, and R. C. Wyatt.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062795, Price codes: A06 in paper copy, A01 in microfiche. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report R-78-2, October 1978. 115 p, 8 Tab, 22 Ref, 2 Append.

Descriptors: *Recreation, *Recreation facilities, *Data collections, *Information systems.

This report examines ways to improve the visitation input data to the Recreation Resource Management System (RRMS) and evaluates the need for an overall recreation information system. An important information need Corps-wide is to forecast the impact of national and regional trends in recreation participation growth, sale of various types of recreation equipment and other factors that affect park area use. The development of a supplemental recreation information system that could be used with existing systems was proposed. A supplemental system would provide planners and managers with better tools to handle basic functions such as project feasibility, site planning, management, etc. Five major tasks are identified regarding improvement of visitation data and development of an overall information system: (a) Research and analysis; (b) Collection and storage of data; (c) Computer requirements; (d) Training and quality control; (e) Reporting. These functions are described and the advantages and disadvantages associated with four administrative decision scenarios are examined. The conclusion is that the Waterways Experiment Station should expand its role to include improvement of the visitation data and undertake development of a supplemental information system. A final part of the report identifies and discusses major administrative aspects associated with this conclusion. (WES)
W80-00920

GENERATION AND EVALUATION OF ALTERNATIVE PLANS FOR REGIONAL WASTEWATER SYSTEMS: AN IMPUTED VALUE METHOD,
Louisville Univ., KY. Dept. of Chemical and Environmental Engineering
For primary bibliographic entry see Field 5D.
W80-00982

A METHODOLOGY FOR THE SELECTION OF AQUATIC NATURAL AREAS,
Idaho Univ., Moscow, ID. Dept. of Biological Sciences.
F. W. Rabe, and N. L. Savage.
Biological Conservation, Vol 15, No 4, p 291-300, June, 1979. 1 Fig, 2 Tab, 10 Ref. OWRT A-046-IDA (2).

Descriptors: *Aquatic environment, *Preservation, *Methodology, *Land management, Physical properties, Biological communities, Wetlands, Habitat.

A methodology is presented for selection of aquatic natural areas based on numerical ranking of sites. Non-weighted points are assigned to 24 physical and biological characteristics of the aquatic and terrestrial components of a proposed natural area. Cumulative score reflects both natural diversity and occurrence of unusual species or conditions. A systematic selection procedure is described which can be utilized by land managers and natural area organizations to arrive at and support objective decisions involving natural area selection. (Howard-Mass)
W80-00986

ECONOMIC IMPACT OF THE SELENIUM EFFLUENT STANDARD IN ILLINOIS (R76-21),
Northern Illinois Univ., De Kalb. Dept. of Geology.
R. C. Flemal, R. W. Crown, B. E. Morgan, and D. C. Wilkin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 173, Price codes: A05 in paper copy, A01 in microfiche. Illinois Institute for Environmental Quality, Doc No 77/34, October 1977. 88 p, 32 Tab, 94 Ref, 2 Append.

Descriptors: *Illinois, *Selenium, *Water quality standards, *Economic impact, *Effluents, *Regulation, *Water pollution control, Water pollution, Water quality, Economics, Cost-benefits analysis, Technology, Water policy, Toxicity, Chemicals, Pollutants.

The principal economic impact of a proposed Illinois amendment deleting the selenium (Se) effluent standard from water quality regulations is the $20 savings per sample charged to dischargers for water analysis. This study evaluates natural Se occurrences; levels, trends, sources in surface waters and effluent discharges; environmental impact, and costs and benefits of regulation versus deregulation. In Illinois detectable Se background concentrations are found only in a few streams. The metalloid is used widely in industrial processes however, only petroleum refining industries have significant seleniferous effluent records. Se is an essential nutrient for many plants and animals; it is also toxic in large amounts (0.05-2.0 mg/l) to plants, animals and humans. Present Illinois standards limit Se concentrations to one mg/l, except where water is used for public water supply with 0.01 mg/l standards. On 24 June 1975, the Marathon Oil Company at Robinson had a 3.08 mg Se/l discharge, the only discharge above the normal standards. Numerous discharges occur above the 0.01 mg Se/l standards, however, not all of these discharges occur in public water supply streams. Although Marathon's effluent affects water quality at outfall and downstream locations by completely eliminating animal life, nothing can be said about specific Se impacts in the effluent. The proposed amendment deleting Se effluent standards, will therefore, have no impact on the people of Illinois (Danovich-Wisconsin)
W80-00989

ECONOMIC IMPACT OF IRRIGATED AGRICULTURE IN WEST MINNESOTA,
Minnesota Univ., Minneapolis. Dept. of Agriculture and Applied Economics
W. R. Maki, L. A. Laulainen, M. Chen, and D. R. Newell.
Minnesota University, Miscellaneous Report 151-1978. 24 Tab.

Descriptors: *Economics, *Irrigation, *Benefits, *Agriculture, *Regional development, Minnesota, Employment, Economic impact, Investment, Direct benefits, Population, Land development, Irrigated land, Production, Numerical analysis, Income, Industries, Model studies, Demand.

Total direct, indirect, and induced economic impact of irrigated agriculture development in West Minnesota is projected at $106,132,000 (1970 dollars) for 1985, equivalent to 10.9% gross regional product in 1970. The 1985 total irrigation economic impact equals $400 per person benefits (1970 dollars) for the 265,000 people projected for West Minnesota. This benefit occurs largely because of additional jobs supported by expanded agriculture-related activity and expanded household expenditures. Four statistics summarize irrigation development economic impacts: gross regional product (GRP), employment, gross output, and investment multipliers. For the 1970-85 period, the multipliers are: 5.7 for investment, 2.7 for employment, 2.2 for GRP, and 1.6 for gross output. GRP is the most informative multiplier for development planning purposes, showing total value added to gross regional and national product by $1 of value added from agricultural development. Direct impacts on 1985 gross regional product is projected at $47.8 million. Total 1985 employment under agricultural development is projected at 98,906, an increase of 5,359 jobs over baseline figures. The development increment in agricultural output is estimated at $146,535,000. An additional $3,100 of gross regional product is created by an added $1,000 investment costs; for the total economy, $5,704 of gross regional product is created for the same investment. (Danovich-Wisconsin)
W80-00990

LAKE KINNERET FISHING AND ITS DEVELOPMENT,
Hebrew Univ., Jerusalem (Israel). Dept. of Zoology.
K. Reich.

Bamidgeh, Vol 32, No 2, p 37-64, June 1978. 10 Fig, 5 Tab, 23 Ref.

Descriptors: *Commercial fishing, *Lake Kinneret(Israel), *Resources development, *Fish harvest, Fishing, Nets, Fishing gear, Fish, Bleak, Tilapia, Barbel, Carp, Mullet, Fish management, Fish stocking, Israel, Fisheries, Economics, Aquatics environment, Marketing.

Commercial fishing in Lake Kinneret, Israel, between 1935 and 1976 is reviewed. During this period, mean yearly catch has increased 6.5-fold from 265 tons in 1935-40 to 1,748 tons in 1969-73. At the same time, yearly catch per fisherman has increased from 1.5-2.0 tons to approximately 9.7 tons. Changes in environmental conditions, fishing regulations which protect young fish, increased marketing possibilities, stocking of new species, and especially technological development of fishing methods are responsible for this growth. Yield according to main fish groups is outlined. The haul of bleak has grown almost 10-fold during the 40 years to a current level of 1,046 tons per year, and is expected to level off at an annual mean of 1,250-1,300 tons. Two stages of growth are noted, the first due to the development of illuminated fishing and greater marketing possibilities, and the second due to environmental changes which increased the bleaks natural breeding rate. Barbel yield decreased from 90 tons per year during 1935-47 to 40 tons in 1949-54, but has increased to a constant 130 tons with the introduction of nylon and monofil fiber nets. The Tilapia catch has increased from an annual mean of 55 tons to 325 tons. The Carp yield despite its high market price has remained low since its introduction in the early 1940's. Mullet stocking has produced very favorable results with 122 tons of fish retrieved for each million fingerlings planted. Exploitation of silver carp, the fish best suited to the lakes biological condition, presents technical and economic problems. It is concluded that the lakes fishing potential has not yet peaked. (Luedtke-Wisconsin)
W80-00991

OPTIMAL HARVESTING POLICIES AND REGULATIONS FOR RENEWABLE RESOURCES,
Pittsburgh Univ., PA. Dept. of Economics.
T. Takayama, and M. Simaan.
University of Illinois (Urbana-Champaign) Faculty Working Papers No 466, February 10, 1978. 16 p, 7 Fig, 4 Ref.

Descriptors: *Optimization, *Mathematical models, *Harvesting, *Resource development, *Resources, *Regulation, *Natural resources, Equations, Economics, Dynamic programming, Fishing, Commercial fishing, Fisheries, Water policy, Fish harvest, Population, Conservation, Management, Exploitation, Production, Theoretical analysis, Growth rates.

This paper develops a dynamic theory for optimally managing renewable resources such as fish, whale, deer or forests, to prevent their extinction while insuring adequate supply levels for human consumption. The optimal policy, which maximizes total harvest, consists of a no-harvest period followed by harvesting at maximum allowable rates. This policy corresponds to a seasonal harvesting law, where each year harvesting is allowed only during a certain 'hunting or fishing' season. Regulating withdrawal rates is not necessary as long as regulations on terminal populations are imposed. Withdrawal rates are then set by the maximum technologically feasible rate, automatically limiting harvesting periods. Policies obtaining maximum sustainable yield are not optimal since they lead to early species extinction and do not result in maximum total harvest. Seasonal harvesting meets several requirements; it does not exceed technological or conservational considerations; it results in resource population levels conserved at the end of a given time horizon; it maximizes total quantity harvested. Regulatory agencies face problems determining and recommending maximum allowable harvesting intensities that will sustain adequate species levels for continued growth. The producing sector faces problems determining an optimal withdrawal policy that maximizes production without violating regulatory agency requirements. The model takes into account the interplay between production sector and regulatory agency policies. (Danovich-Wisconsin)
W80-00994

COST-BENEFIT ANALYSIS AND ENVIRONMENTAL EFFECTS,
Ecole Polytechnique, Paris (France).
P. Bohm, and C. Henry.
Ambio, Vol 8, No 1, p 18-24, 1979. 5 Fig, 5 Ref.

Descriptors: *Cost benefit analysis, *Cost benefit theory, *Decision making, *Environmental effects, France, United States, Case studies, Risks, Water pollution, Air pollution, Forests, Oil industry, Oil refinery, Political aspects, Hydroelectric plants, Hell's Canyon(ID).

Cost-benefit analysis (CBA) is used in three case studies to illustrate its value in reducing a problem with multi-dimensions to one with fewer dimensions, thus making the problem more manageable. CBA also can insure that no particular aspect is unduly favored or ignored and that uncertainties, indivisible concerns, risk premiums, irreversibility, and option value are taken into account. Because CBA examines relevant questions and gives appropriate weight to both the institutional framework and to distribution of benefits and costs among various affected publics, it helps the environmental considerations to political decision making. The problems considered are: (1) whether or not an oil refinery should be constructed in an unpolluted fishing and marine life zone in Roadstead Bay of Brest, France; (2) whether a highway connecting the suburbs of Paris should be allowed to cross the beautiful forests of Malmaison, Versailles, etc.; and (3) whether or not unique Hell's Canyon, in the United States should be used for a hydroelectric dam. These case studies show difficulties which arise where decisions are made without analysis, or with analysis but without an overall perspective. (Luedtke-Wisconsin)
W80-00995

WATER POLLUTION CONTROL THEORY -- AN ECONOMIC TAXONOMY,
Newcastle-upon-Tyne Univ. (England). Dept. of Economics.
D. J. Storey, and M. Walker.
Journal of Environmental Management, Vol 7, No 3, November 1978, p 205-217. 8 Fig, 31 Ref.

Descriptors: *Planning, *Water pollution control, *Standards, *Economics, Non-structural alternatives, Regulation, Administrative agencies, Water quality standards, Water policy, Theoretical analysis, Methodology, Water policy, Pollution taxes(Charges), Costs, Benefits, Effluents.

A framework is suggested within which various 'best' policies for controlling discharge of polluting material to natural waterways may be compared objectively. The framework, distinguishing between decisionmaking information generated prior to the setting of the standard and choice of policy as opposed to information generated by observation of policies in operation, suggests that comparison of policies should take place on the basis of efficiency, equity and effectiveness. The taxonomy has three aims: (1) It is intended to ensure that economists evaluating water pollution control policies examine all the criteria outlined in the evaluation process. (2) It serves to highlight, under uncertainty, the impossibility of divorcing standards-setting from an evaluation of control policies. (3) It demonstrates that in most cases, some estimates of likely benefits of improvement are necessary because of the likelihood of clashes between criteria and sub-criteria. Only by applying the taxonomy in detail to individual control schemes is it possible to evaluate fully the merits of charging, subsidies, shares schemes or regulation. In demonstrating the taxonomy, differences are graphically illustrated between the traditional and adaptive models of decisionmaking. Both models begin the collection of a priori information from benefit-cost analysis, then follow through with choosing a strategy, selecting a policy, and implementing to achieve a standard. But in the adaptive model, there is an inerative step in which strategies and policies are revised after a posteriori information is collected. (Harris-Wisconsin)
W80-00996

INVESTING RETURNS FROM DEPLETING RENEWABLE RESOURCE STOCKS AND INTERGENERATIONAL EQUITY,
Queen's Univ., Kingston (Ontario).
J. M. Hartwick.
Economic Letters, Vol 1, No 1, p 85-88, 1978. 8 Ref.

Descriptors: *Economics, *Investment, *Natural resources, *Mathematical models, *Equity, Capital, Resources, Equations, Model studies, Dynamic programming, Fish stocking, Forestry, Mineralogy, Production, Resource allocation, Social aspects, Exploitation, Mathematical studies.

Per-capita consumption will remain constant over time (assuming no changes in technology or population) if along dynamically efficient development paths, net current diminution natural resource stocks value, renewable and non-renewable, is invested in reproducible capital. A savings-investment rule, investing current exhaustible resource rents in reproducible capital, leads to intergenerational equity in that per-capita consumption remains constant across generations in a large situation range. This rule is valid for stocks of renewable resources such as fish and forest stocks, as well as non-renewable resources, such as minerals. A mathematical model is proposed with four inputs into production: reproducible capital, mineral resource flows, renewable resource flows, and labor. If all inputs are held constant except one, an increase in that stock implies it will be less costly for later generations to exploit it, and vice-versa for stock declines. A combination of renewable and exhaustible resources leads to the non steady-state character of the efficient equitable path. Paths are sensitive to the substitutability of resource flows and reproducible capital. Constant per-capita consumption, as a result of technical progress equalling population growth rate, does not hold in the proposed model with renewable resources. (Danovich-Wisconsin)
W80-00997

CALIFORNIA WATER PLANNING AND POLICY: SELECTED ISSUES,
For primary bibliographic entry see Field 6E.
W80-01000

ECONOMICS OF WEATHER MODIFICATION: A REVIEW,
Illinois State Water Survey, Urbana.
S. T. Sonka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110398, Price codes: A04 in paper copy, A01 in microfiche. Report of Investigation 89, 1979. 57 p, 3 Fig, 14 Tab, 67 Ref. NOAA 7-14291.

Descriptors: *Weather modification, *Economics, *Reviews, *Economic impact, Cost-benefit analysis, Rainfall, Hurricanes, Meteorology, Cloud seeding, Costs, Indirect costs, Agriculture, Recreation, Construction, Water supply, Transportation, Hail suppression, Precipitation augmentation, Snowpack enhancement.

This report discussed gross benefits and costs of potential weather modification activities and the elements vital to a credible economic analysis of such activities. It reviewed and evaluated more than 60 existing studies relating to the economic impacts of 5 major modification activities: precipitation augmentation including snow-pack enhancement, hail suppression, hurricane suppression, fog dispersal, and lightning suppression. Because weather can have severe adverse effects on economic activity, gross benefits of modification appear very high in relation to most operational costs. However, indirect costs may be great, and, in general, those adversely affected are not the same individuals enjoying the gross benefits. A credible economic analysis of net benefits of weather modification requires consulting with at-

mospheric scientists to assure understanding of the physical factors involved, funding for a considerable amount of data gathering, considering effects of possible future changes in crucial factors, and orienting the analytical viewpoint to both negative and positive regional economic impacts. Most of the existing literature relating to the economics of weather modification addresses precipitation augmentation and hail suppression; very few attempts toward comprehensive economic analyses have been made. More is known about the economic impacts of weather on agriculture than for any other activity area. Probably the most important aspect in determining the credibility of any economic analysis, however, is the viewpoint of that analysis. In conducting such an analysis, it should be clear that the goal of the analysis is to determine the effects of the modification activity on the entire economy of a region, not just impacts on those sectors which derive benefits from the planned activity. (Humphreys-ISWS)
W80-01008

6D. Water Demand

AN ACTIVITIES MODEL OF CONSUMER BEHAVIOUR WITH SPECIAL REFERENCE TO OUTDOOR RECREATION,
Australian National Univ., Canberra. Centre for Resource and Environmental Studies.
A. M. Ulph, and I. K. Reynolds.
Scottish Journal of Polytical Economy, Vol 26, No 1, p 33-60, February 1979. 1 Fig, 40 Ref.

Descriptors: *Travel cost method, *Willingness-to-pay, *Cost benefit analysis, *Recreation demand, Model studies, Recreation, Recreation facilities, Reviews, Theoretical analysis, Evaluation, Social participation, Visits, Parks, Costs, Benefits, Methodology, Decision making

Travel cost methods are used to study factors which effect demand for outdoor recreation facilities or modes of transport, and as analytical techniques in cost-benefit studies of new projects. A general theoretical framework is developed to access the wide variety of methods employed by researchers using travel cost methods to evaluate recreation benefits, and to provide a more consistent travel cost approach. The general model indicates that money costs which should be considered in a travel cost analysis are the cost of on-site goods and services consumed and expenditure on goods and services made while travelling, essentially gas and car services. Other independent demand variables are analyzed including income and the prices of substitute activities. Additional needs not fully covered by the model are also discussed. There is a need to consider the sequence of decision involved in undertaking outdoor recreation including how many sites to visit, how long to spend at each site, and whether or not to undertake a trip at all. A characteristic approach should be used to examine new sites or changes in the management for existing sites instead of the activities approach. Last, compensated rather than uncompensated demand curves are needed. All of these developments must be incorporated into the model simultaneously. (Luedtke-Wisconsin)
W80-00992

WATER RESOURCES AND INDUSTRIAL DEVELOPMENT IN MISSISSIPPI: OPPORTUNITIES AND CONSTRAINTS,
Mississippi Univ., University. Bureau of Business and Economic Research.
K. W. Hollman, S. C. Shull, R. S. Glaze, and S. A. Simmons.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110877, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, Mississippi State, Report, September, 1979, 58 p, 12 Tab, 70 Ref. OWRT A-128-MISS (1). 14-34-0001-9026.

Descriptors: *Industrial water, *Economic impact, *Mississippi, Regression analysis, Water supply, Water law, Water demand, Water resources development, Multivariate analysis, Water conflicts, Economic planning, Industrial development, Source of supply.

The recent increase in industrialization and urbanization in the State of Mississippi has begun to tax water supplies in some areas of the state. Concurrently, state and local agencies and elected officials are becoming increasingly involved in the solicitation of new and expanded industrial development within the state. The supply and availability of water resources should be a major concern of those officials as well as of private industrial decision makers, particularly those whose production techniques require substantial quantities of water or water of specified quality. This study accumulated data on industrial water demands in Mississippi through a questionnaire survey of 585 manufacturing firms in the State. Firms were questioned about water use and discharge characteristics and recent conflicts (if any) over the use of water. Also, procedures were developed to estimate future industrial water requirements through the use of a multiple regression model. Findings are presented in tabular form to facilitate comprehensibility. The knowledge uncovered and tools developed in the study will aid in the development of meaningful decision rules in the planning process which reflect the physical, economic, legal, and social aspects of water management in Mississippi
W80-01003

ALPINE LAKES IN KINGS CANYON NATIONAL PARK, CALIFORNIA BASELINE CONDITIONS AND POSSIBLE EFFECTS OF VISITOR USE,
California Univ., Berkeley. Dept. of Forestry and Conservation
For primary bibliographic entry see Field 5C.
W80-01116

6E. Water Law and Institutions

MILITARY USES OF OCEAN SPACE AND THE DEVELOPING INTERNATIONAL LAW OF THE SEA: AN ANALYSIS IN THE CONTEXT OF PEACETIME ASW,
Department of Agriculture, Washington, DC. Foreign Agriculture Div.
R. J. Zedalis.
San Diego Law Review, Vol 16, No 3, p 575-644, 1979.

Descriptors: *International law, *Submarines, *United nations, *Military aspects, Law of the sea, International waters, Conferences, Legal aspects, Governments, Regulation

The international legal prescriptions regulating peacetime military uses of ocean space other than passage through straits used for international navigation are analyzed. More specifically, the focus is on peacetime anti-submarine warfare (ASW), conducted below the navigable water surface. The legal regions of the 1958 Geneva Convention on the Law of the Sea and the Third United Nations Conference on the Law of the Sea (UNCLOS III) are compared as to the following subject areas: (1) the internal waters and territorial sea; (2) the high sea; (3) the continguous zone; (4) the exclusive economic zone; and (5) the deep seabed. The negotiating texts produced at UNCLOS III provide a more desirable legal regime. As to military use of the ocean's seabed and surface, the proscriptive regime of UNCLOS III allows easy verification of state observance. (MacGregor-Florida)
W80-00801

MONOPOLY-POWER AS A MEANS FOR POLLUTION CONTROL,
A. Endres.
The Journal of Industrial Economics, Vol 27, No 2, p 185-187, December 1978. 5 Ref.

Descriptors: *Water pollution control, *Monopoly, Equations, Optimization, Competition, Taxes, Industries, Pollution abatement, Marginal costs

Monopoly power never corrects allocative failures of external diseconomy because monopolists do not use efficient input mixes. This paper compares perfectly competitive polluting firms and damaged firms in Pareto-optimal situations. If perfectly competitive polluting industry firms are forced by taxes to bear marginal damages they cause, Pareto-optimal output and pollution level will be produced. If monopolists take over competitive polluting industry, the same output and pollution levels are produced as perfectly competitive industries, regulated by Pignovian taxes. However, no incentives exist for unregulated polluting monopolists to employ any resources in additional abatement methods. Therefore, since taxes on perfectly competitive economies produce less output, monopoly power as a means for pollution abatement is just as inefficient. (Danovich-Wisconsin)
W80-00998

THE STANISLAUS RIVER DRAINAGE BASIN AND THE NEW MELONES DAM: HISTORICAL EVOLUTION OF WATER USE PRIORITIES,
California Univ., Davis. Dept. of History.
W. T. Jackson, and S. D. Mikesell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110828, Price codes: A09 in paper copy, A01 in microfiche. Contribution 178, California Water Resources Center, University of California, Davis. June 1979, 184 p, 10 Fig, 10 Tab. (California Water Resources Center Project UCAL-WRC-W-524).

Descriptors: *History, *Rivers, *Jurisdiction, *Federal-State water rights conflicts, *Planning, *Decision making, Priorities, Governments, Constraints, Political constraints, Institutional constraints, Water districts, Attitudes, Motivation, Social aspects, Political aspects.

The evolution of water use priorities for the Stanislaus River goes beyond the highly-publicized contest of the 1970s between the federal water agencies and the environmentalists over construction of the New Melones project. Since the 1850s, plans for development of the Stanislaus River have passed through several distinct phases, each reflecting the prevailing values and objectives. These phases, analyzed topically and chronologically in this report, include: a private phase, dominated by mining-related and subsequently by the electric utility interests; a local phase, dominated by irrigation districts, culminating in construction of the Tri-Dam Project in the late 1950s; an early federal phase, in which the Bureau of Reclamation and the Corps of Engineers competed for jurisdiction for the New Melones Dam; a phase of federal-state cooperation, in which numerous federal and state agencies negotiated for the best design for the New Melones project; an opposition phase, in which the environmentalists criticized the New Melones project; and a period of stalemate in the 1970s, in which intense private opposition, high-level federal-state conflict, and persistent litigation in federal court have precluded full operation of the completed new melones project. (Snyder-Cal)
W80-00999

CALIFORNIA WATER PLANNING AND POLICY: SELECTED ISSUES,
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110349, Price codes: A12 in paper copy, A01 in microfiche. Water Resources Center, California University, Davis, June 1979, 251 p. 15 Fig, 31 Tab, 1 Append. OWRT A-999- CAL (15).

Descriptors: *Planning, *Water Resources, *Water resources development, *Project planning, Long term planning, Projections, Research and development, Legislation, Administration, Droughts, Decision making, Management, Research priorities, Alternate planning, Regional development, California.

This volume grows out of research and seminars sponsored by the University of California to address some of the major issues of California water planning and policy. Its purpose is to provide information and evaluation for selected water problems for State legislative and administrative officials and for others who are involved with

California's decision-making system for water resources. Participating in the seminars were representatives of business, labor, governmental, educational and civic organizations. At the first three-day seminar held at the University of California, Santa Cruz, in May 1978, seminar participants reviewed the range of California Water problems and selected ten priority issues for further policy study. Public policy papers were prepared on these issues and discussed at a second three-day seminar held in Asilomar in March 1979. This volume is composed of the public policy papers which were discussed at the Asilomar Seminar. All of the papers are organized around four headings, namely (1) Statement of the Problem (2) Background, (3) Policy and Program Alternatives and (4) Suggested Program for Research and Action. (Snyder-Calif)
W80-01000

EMERGENCIES IN WATER DELIVERY,
California Univ., Irvine. School of Engineering.
For primary bibliographic entry see Field 7A.
W80-01001

MAR DEL PLATA ACTION PLAN,
For primary bibliographic entry see Field 6A.
W80-01109

6G. Ecologic Impact Of Water Development

ECONOMIC IMPACT OF THE SELENIUM EFFLUENT STANDARD IN ILLINOIS (R76-21),
Northern Illinois Univ., De Kalb. Dept. of Geology.
For primary bibliographic entry see Field 6B.
W80-00989

PARTIAL DROUGHT CONDITIONS IN NEPAL,
Ground Water Resources Development Board, Kathmandu (Nepal).
For primary bibliographic entry see Field 2B.
W80-01033

7. RESOURCES DATA

7A. Network Design

WATER-RESOURCES INVESTIGATIONS IN KANSAS, 1978,
Geological Survey, Lawrence, KS. Water Resources Div.
Geological Survey Water-Resources Investigations in Kansas Folder, 1979. 1 Sheet.

Descriptors: *Water resources, *Investigations, *Inter-agency cooperation, *Kansas, Surveys, Planning, Hydrologic data, Basic data collections, Precipitation(Atmospheric), Streamflow, Runoff, Sediment yield, Groundwater, Water quality, On-site investigations, Dissolved solids, Bibliographies, Networks, Maps, *Cooperative water-studies program.

Water-resources studies and investigations in Kansas made by the U.S. Geological Survey in cooperation with State and local agencies are summarized. A bibliography of selected material concerning these investigations is included. The investigations include collections of basic information through a hydrologic-data network, areal hydrologic or interpretative studies, and research projects. The hydrologic-data network consists of primary, secondary, and water management streamflow stations; ground water observation wells; and water quality observation sites. Small State maps show mean annual precipitation, mean annual runoff, annual mean sediment yields of streams, principal sources of ground water, discharge of principal rivers, and the dissolved solids in streams. A larger map shows by symbols, numbers, and colored outline the hydrologic-data network and investigations in Kansas as of October 1977. (Woodard-USGS)
W80-00944

A NOTE ON THE DUAL-GAGE AND WYOMING SHIELD PRECIPITATION MEASUREMENT SYSTEMS,
Science and Education Administration, Boise, ID. Northwest Watershed Research Center.
For primary bibliographic entry see Field 2B.
W80-00957

STATISTICAL EVALUATION OF SAMPLING FREQUENCIES IN MONITORING NETWORKS,
Colorado State Univ., Fort Collins.
R. C. Ward, J. C. Loftis, K. S. Nielsen, and R. D. Anderson.
Journal of Water Pollution Control Federation, Vol 51, No 9, p 2292-2300, September 1979. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Monitoring, *Water sampling, *Water quality, *Statistical models, Evaluation, Analytical techniques, Networks, Frequency, Variability, Statistics, Quality control, Correlation analysis, Stochastic processes, Sampling frequency.

Recent events in regulatory water quality monitoring have permitted a refinement in the goals for monitoring networks. This paper described a procedure that incorporates basic statistics into the evaluation of sampling frequencies in these monitoring networks. The procedure attempts to obtain uniform levels of information from all stations by allocating samples to each station based on its proportional variation in quality relative to the total variation in the network. A means of measuring the overall improvement in uniformity of information was developed. In applying the procedure to Colorado's San Juan Basin monitoring network, a 31.43% improvement in uniformity was obtained by allocating samples based on water quality variation rather than by simply allocating an equal number of samples to all stations. As future research is performed in developing more thorough evaluation procedures, it was recommended that the practical application not be forgotten. This will require knowledge of the type and level of statistics being used on a practical basis by the many water quality management agencies and carefully building on it. (Humphreys-ISWS)
W80-00976

EMERGENCIES IN WATER DELIVERY,
California Univ., Irvine. School of Engineering.
R. Schinzinger, and H. Fagin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110372, Price codes: A07 in paper copy, A01 in microfiche. Contribution 177, Water Resources Center, Calif. Univ., Davis. June 1979, p 131, 33 Fig, 16 Tab, 1 Append. (California Water Resources Center Project UCAL-WRC-W-498). OWRT-B-178-CAL (8).

Descriptors: *Water supply, *Water delivery, *Disasters, *Failures, *Potential water supply, Planning, Alternative planning, Civil defense, Water conveyance, Structures.

Severe impacts could result from an interruption of long water supply lines for which continuous fault free operation is too often taken for granted. The need for contingency planning--which encompasses not only preparations in anticipation of a disaster event but also operations during an emergency--is emphasized. The stage is set by a review of water needs in residential, institutional, industrial, and agricultural use as well as both a discussion of the nature of disasters with particular attention to public response and the vulnerability of water systems. The emergency operations which are investigated include: recognition of an emergency, communication and coordination, allocation mechanisms, the effect of rate structures, restoration policies, and mutual assistance. Throughout the study a particular, medium-sized water agency in the San Diego region is cited as an example, but the use of generalized models extends the applicability of the findings. (Snyder-Calif)
W80-01001

7B. Data Acquisition

APPLICATION OF TRANSIENT-FLOW MODEL TO THE SACRAMENTO RIVER AT SACRAMENTO, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2L.
W80-00940

A NOTE ON THE DUAL-GAGE AND WYOMING SHIELD PRECIPITATION MEASUREMENT SYSTEMS,
Science and Education Administration, Boise, ID. Northwest Watershed Research Center.
For primary bibliographic entry see Field 2B.
W80-00957

RADAR MEASUREMENT OF RAINFALL--A SUMMARY,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 2B.
W80-01036

THE FRONTIERS PLAN: A STRATEGY FOR USING RADAR AND SATELLITE IMAGERY FOR VERY-SHORT-RANGE PRECIPITATION FORECASTING,
Royal Signals and Radar Establishment, Malvern (England). Radar Research Lab.
For primary bibliographic entry see Field 2B.
W80-01038

INTEGRATED COMPUTER-BASED DATA ACQUISITION SYSTEM UTILISING RADIO COMMUNICATIONS,
Aqua--The Journal of the International Water Supply Association, No 4, p 3-10, 1979. 6 Fig.

Descriptors: *Telemetry, *Data collections, *Data transmission, *Electronic equipment, Groundwater, Wells, Water wells, Water levels, Rivers, River flow, Flood warning, Water pollution, Water resources, Rainfall, Radio communication systems, Radio waves, Microwaves, Monitoring, Remote sensing, Data acquisition systems.

This article describes at a basic level the techniques employed in wide area computer-based telemetry schemes utilising radio communications. An integrated system design approach, with regard to the main elements of communications, outstations, and control centres, is illustrated by a comprehensive data acquisition system currently being implemented for the Thames Water Authority Great Britain by Plessey Radar Limited. (Sims-ISWS)
W80-01040

STOCHASTIC WATER QUALITY MODEL,
Auburn Univ., AL. Dept. of Civil Engineering.
L. C. Bell.
In: Verification of Mathematical and Physical Models in Hydraulic Engineering. Proceedings of 26th Annual Hydraulics Division Specialty Conference, University of Maryland, College Park, Maryland, August 9-11, 1978. p 638-644 (1978) American Society of Civil Engineers. New York, N.Y.

Descriptors: *Wastes, *Receiving streams, *Dissolved oxygen, Model studies, Path of pollutants, *Stochastic water quality model, DOSIM.

Water quality planners have traditionally relied heavily on deterministic (non-probabilistic) computer models to predict the effects of alternate waste load criteria on receiving streams and rivers. Computer programs such as STREM and DOSAG-I have been used to determine stream dissolved oxygen concentrations under arbitrary or assumed headwater, stream, and effluent conditions. No attempt is made to determine the probability of occurrence of the computed dissolved oxygen concentrations. Researchers at Auburn University applied deterministic water quality models to 33 stream segments throughout the State

of Alabama in 1974 and 1975 (1). This experience led to the conclusion that the highly variable conditions normally encountered in small creeks and streams could be simulated more accurately using a stochastic water quality model.
W80-01163

UTILIZING AN INFRARED THERMOMETER FOR AIR TEMPERATURE MEASUREMENTS,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
S. G. Grannes, D. C. Slack, and E. R. Allred.
Paper No 78-2548, presented at 1978 Winter meeting American Society of Agricultural Engineers, Chicago, ILL., Dec. 18-20, 1978. 19 p, 5 Fig, 1 Tab, 10 Ref, ASAE, St. Joseph, Michigan. OWRT A-037-MN (1).

Descriptors: *Air temperature, *Measurement, *Evapotranspiration, *Analytical techniques, Instrumentation, Evaluation, *Infrared thermometer.

A system for determining air temperature with an infrared thermometer has been developed. This method utilizes a shielded black body emitter as an atmospheric temperature reference. The emitter has been shown to approach air temperature to within 0.13oC. This measurement system is especially useful in convective heat exchange studies between naturally exposed surfaces and the atmosphere. (Blake-Minn)
W80-01200

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR VIRGINIA, WATER YEAR 1978,
Geological Survey, Richmond, VA. Water Resources Div.
Geological Survey Water-Data Report VA-78-1, June 1979. 413 p, 4 Fig, Append.

Descriptors: *Virginia, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Virginia consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 197 gaging stations, stage only at 1 gaging station, stage and contents at 9 lakes and reservoirs, water quality at 44 gaging stations, and water levels at 63 observation wells. Also included are data for 69 crest-stage partial-record stations. Locations of these sites are shown on maps. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia. (Woodard-USGS)
W80-00932

MAPS SHOWING GROUND-WATER CONDITIONS IN THE NEW RIVER-CAVE CREEK AREA, MARICOPA AND YAVAPAI COUNTIES, ARIZONA--1977,
Geological Survey, Tucson, AZ. Water Resources Div.
G. R. Littin.
Geological Survey Water Resources Investigation open-file report 79-1068 June 1979. 2 Sheets, 10 Ref.

Descriptors: *Groundwater, *Maps, *Water wells, *Water levels, *Water quality, Specific conductivity, Fluoride, Aquifers, Geology, Arizona, *Maricopa County(AZ), *Yavapai County(AZ), New River Area(AZ), Cave Creek Area(AZ).

The New River-Cave Creek area includes about 500 square miles in central Arizona. The groundwater conditions vary greatly owing to large differences in rock type and extent of fracturing. Information shown on the maps includes depth to water, altitude of the water level, well depth, and specific conductance and fluoride concentration in the water. Scale 1:125,000. (Woodard-USGS)
W80-00933

CONFIGURATION OF THE TOP OF THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND ADJACENT AREAS,
Geological Survey, Tallahassee, FL. Water Resources Div.
A. Buono, and A. T. Rutledge.
Geological Survey Water-Resources Investigations 78-34 (open-file report), June 1979. 1 Sheet, 17 Ref.

Descriptors: *Maps, *Aquifers, *Geohydrologic units, *Elevation, *Wellpoints, Contours, Hydrogeology, Water wells, Florida, *Floridan aquifer, Southwest Florida Water Management District.

This map depicts the approximate top of the rock that composes the Floridan aquifer. The contours represent the elevation of the top of the Floridan aquifer to mean sea level. Rock units recognized to be part of the Floridan aquifer are limestone and dolomite ranging from middle Eocene to early Miocene. They are Lake City Limestone, Avon Park Limestone, Ocala Limestone, Suwannee Limestone, and Tampa Limestone. In this report, the top of the Floridan aquifer is a limestone defined as the first consistent rock of early Miocene age or older below which occur no clay confining beds. Although the Hawthorn formation of middle Miocene is considered part of the Floridan aquifer when it is in direct hydrologic contact with lower lying rock units, it is not considered here because of a lack of detailed delineation of areas where contact exists. (Woodard-USGS)
W80-00934

WATER RESOURCES DATA FOR NORTH CAROLINA, WATER YEAR 1978,
Geological Survey, Raleigh, NC. Water Resources Div.
Geological Survey Water-Data Report NC-78-1, March 1979. 515 p, 4 Fig.

Descriptors: *North Carolina, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for North Carolina consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 148 gaging stations, stage and contents for 24 lakes and reservoirs, water quality for 146 gaging stations, and water levels for 59 observation wells. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements in this report. The collection of water-resources data in North Carolina is a part of the National Water-Data System operated by the U.S. Geological Survey in cooperation with State, municipal, and Federal agencies. (Woodard-USGS)
W80-00939

WATER-RESOURCES INVESTIGATIONS IN KANSAS, 1978,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-00944

PUBLIC GROUNDWATER SUPPLIES IN CARROLL COUNTY,
Illinois State Water Survey, Urbana.
D. M. Woller, and E. W. Sanderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-110836, Price codes: A03 in paper copy, A01 in microfiche. ISWS Bulletin 60-28, 1979. 23 p, 3 Fig.

Descriptors: *Water supply, *Illinois, *Groundwater resources, Unconsolidated aquifers, Well data, Gravels, Sand aquifers, Bedrock, Sandstones, Dolomite, Groundwater availability, Groundwater, Hydrology, Hydrogeology, Water sources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells, Geology, Aquifers, *Carroll County(IL), Dissolved minerals, Water bearing formations.

All available information on production wells used for public groundwater supplies in Carroll County, Illinois, was presented. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. The report included separate descriptions for groundwater supplies of 7 municipalities and 1 state park in Carroll County. These were preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for public use. Individual production wells for each supply were described in the order of their construction. The descriiption for each well included the aquifer or aquifers tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, constructionfeatures, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)
W80-00946

COMPUTER APPLICATION TO DOUBLE-MASS ANALYSIS,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Resources Engineering.
B. K. Panigrahi, and A. D. Gupta.
Water Resources Bulletin, Vol 15, No 4, p 1168-1172, August 1979. 2 Fig, 1 Tab, 2 Ref.

Descriptors: *Mass curves, *Computer programs, *Model studies, *Hydrology, Hydrological data, Analytical techniques, Analysis, Data processing, Mathematical models, Foreign research, *Thailand, *Taiwan.

Double-mass analysis for checking consistency of a hydrological record is considered to be essential before taking it for analysis purpose. Because of increasing computer application in hydrological analyses, in this paper a simple and efficient method for the double-mass checking was developed. The problem has been formulated in FORTRAN IV language, and the basic steps and a computer output of the program were presented in a flow chart and a table. The analysis has been successfully applied to a number of data sets of different river basins of Thailand and Taiwan. From a comparison with manual graphical analysis for the data sets, it was concluded that this analysis shows satisfactory agreement with much saving of time. (Humphreys-ISWS)
W80-00970

HYDROMETEOROLOGICAL CHARACTERISTICS OF SEVERE RAINSTORMS IN ILLINOIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2B.
W80-01009

8. ENGINEERING WORKS

8A. Structures

LAKE PUMP SUCTION MECHANISM,
J. W. Hanna.
U.S. Patent No 4,152,264, 3 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 982, No 1, p 219-220, May 1, 1979.

Descriptors: *Patents, *Pumping, *Water delivery, Water sources, Water storage, Bodies of water, Lakes, Equipment, Pumps, Suction pumps

A suction mechanism is submerged underwater in a lake. It is designed to eliminate sand and mud

from entering a foot valve connected to hoses for pumping water out of the lake for use. The suction mechanism includes the foot valve at the upper end of a vertical suction pipe. The foot valve is covered by a protective dome. A horizontal anchor stand supports the suction pipe vertically as well as the lines leading from the lake including a suction pipe and a pressure pipe. (Sinha-OEIS)
W80-00880

MULTI-WALLED BREAKWATER,
T. Ijima.
U.S. Patent No 4,154,548, 12 p, 19 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 982, No 3, p 987, May 15, 1979.

Descriptors: *Patents, *Breakwaters, Engineering structures, Sea walls, Shore protection, Coasts, Harbors.

The invention provides a sea wall having effective blocking ability against a variety of waves having a wide range of wave lengths. The breakwater has a base on the water bottom and a back wall which stands on the base and rises above the water level. A number of front walls which stand on the base are separated from one another and have the same height as the back wall. A support slab projects horizontally from the top end of the back wall and is connected to the top ends of the front walls. Each front wall is pierced by holes, the dimensions of the holes of the front walls decreasing monotonically from the first wall situated at the front of the breakwater to the last wall closet to the back wall. (Sinha-OEIS)
W80-00893

PROCESS FOR BUILDING UP TOWERS, PARTICULARLY WATER TOWERS,
Le Ciment Arme Demay Freres, Marne (France). (Assignee).
J. de Leaumont.
U.S. Patent No 4,155,210, 11 p, 14 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 982, No 4, p 1207, May 22, 1979.

Descriptors: *Patents, *Structures, *Structural design, Structural shapes, Water storage, Storage tanks, Modular structure, Water towers.

A process is provided where molds corresponding to the length of the elements are achieved, and afterwards the molds are subdivided so as to make only segments corresponding to a portion of each element. The size of the segments are selected to allow handling. Then the elements are placed side by side making sure that the elements are subdivided into segments when molding is performed. Thus it is possible to achieve towers consisting of modular elements which can be industrially achieved on the ground. In another characteristic feature of the invention, the lateral edges of the elements (or of the segments constituting the elements) are provided with grooves. The grooves are designed to cooperate one with another so as to make channels designed to receive concrete, glue or any water-proof means. (Sinha - OEIS)
W80-00900

FILLING AND EMPTYING SYSTEM FOR BAY SPRINGS LOCK, TENNESSEE-TOMBIGBEE WATERWAY, MISSISSIPPI; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. H. Ables, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 267, Price codes: A06 in paper copy, A01 in microfiche. Technical Report H-78-19, November 1978. 91 p, 28 Pl, 11 Tab, 4 Photos, 1 Append.

Descriptors: *Locks, *Hydraulic models, Navigation, *Tennessee-Tombigbee Waterway, *Bay Springs Lock and Dam.

This report concerns planning and design of a single lift, 110- by 600-ft lock (pintle to pintle), at the southern end of the Divide Section of the Tennessee-Tombigbee Waterway. Normally, an 84-ft lift condition will obtain, but a maximum of 92 ft or a minimum of 78 ft is possible at the site. A 1:25-scale model was built to study the filling and emptying system. The type system developed in the model test was a longitudinal floor culvert. Culverts in each lock wall are connected to a crossover culvert with a horizontal splitter wall dividing flow to upstream and downstream tuning forks where equal division leads into the two longitudinal floor culverts in each end of the chamber, near the chamber quarter point. The type 17 design model gave filling and emptying times of 10.5 min and 13.3 min. The prototype can be expected to fill and empty about 18 percent faster. Flow conditions in the lock chamber during filling were excellent with a very small degree of turbulence. The system developed is particularly desirable for high-lift locks in that it is insensitive to misoperation. (WES)
W80-00916

INTERACTIVE COMPUTER-AIDED HYDRAULIC DESIGN: CULVERTS,
California State Dept. of Water Resources, Sacramento.
J. D. Spence, and B. E. Larock.
Water Resources Bulletin, Vol 15, No 4, p 1153-1158, August 1979. 2 Tab, 7 Ref.

Descriptors: *Hydraulic design, *Culverts, *Computer programs, Data processing, Hydraulic structures, Hydraulic engineering, Hydraulics, Mathematical models, Analytical techniques, Interactive computer program.

Regular use of interactive computer programs in hydraulic design can materially increase the productivity of designers without sacrificing accuracy. This paper considered the hydraulic design of culverts by interactive use of a computer program. An interactive computer program for the hydraulic design of culverts demonstrated the advantages of speed, convenience, and efficiency over batch programs for the same problem; any additional expenses over batch-mode computing are repaid by increased productivity and accuracy by the user. Primary practical impediment to use is the initial capital cost of terminals, which may be quite modest if they are used to operate a number of interactive programs. (Humphreys-ISWS)
W80-00969

8B. Hydraulics

SOLUTION OF LARGE SCALE PIPE NETWORKS BY IMPROVED MATHEMATICAL APPROACHES,
Southern Methodist Univ., Dallas, TX. School of Engineering and Applied Science.
For primary bibliographic entry see Field 6A.
W80-00869

TYPICAL TENNESSEE-TOMBIGBEE CANAL SECTION SPILLWAYS, SPILLWAYS A AND B: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
B. P. Fletcher.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 730, Price codes: A05 in paper copy, A01 in microfiche. Technical Report H-78-21, November 1978. 72 p, 5 Tab, 7 Photo, 21 Plate, 1 Append.

Descriptors: *Spillways, *Hydraulic models, Flow control, *Tennessee-Tombigbee Waterway.

Model investigations were conducted to determine adequacy of the designs of two gravity spillways (Spillways A and B) to be located on the Tennessee-Tombigbee Waterway. Investigations were primarily concerned with evaluation of the tendency for surging of flow on the spillway tainter gates, defining the discharge characteristics of the structures, and ensuring adequate stilling basin performance. Models indicated basic features of the original design structures were unsatisfactory; however, modifications that improved hydraulic performance were developed. There was no tendency for surging on the tainter gates. Discharge characteristics of both spillways for controlled and uncontrolled flows were determined. Divider walls were located in the stilling basins downstream of the piers to eliminate unsatisfactory flow conditions that occurred during single gate operations. Additional features investigated in the model of Spillway B included measurement of crest pressures. No adverse pressures were observed. Addition of a 45-degree slope to the face of Spillway B did not affect hydraulic performance. The model also indicated stilling basin apron could be raised 9 ft without impairing performance of the structure. Size of riprap needed in the exit channel downstream was determined. Magnitudes of dynamic forces to be expected on the stilling basin divider walls were estimated. (WES)
W80-00917

INTERACTIVE COMPUTER-AIDED HYDRAULIC DESIGN: CULVERTS,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 8A.
W80-00969

UNSTEADY FEATURES OF FLOW PAST A CAVITY,
Lehigh Univ., Bethlehem, PA. Dept. of Mechanical Engineering.
D. Rockwell, and C. Knisely.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY8, Proceedings Paper 14773, p 969-979, August 1979. 7 Fig, 22 Ref, 2 append.

Descriptors: *Flow, *Hydrodynamics, *Turbulence, *Model studies, Hydraulic models, Velocity, Shear, Vortices, Fluid mechanics, Flow characteristics, Unsteady flow, Hydraulics, Cavities, Impingement.

Measurements of the distributions of total turbulence intensity across the shear layer and corresponding power spectra revealed that the presence of the impingement edge of the cavity decreases the total turbulence intensity by as much as 50% to 80% relative to the case of no edge; this decrease in total intensity is associated with the appearance of well-defined peaks in the power spectrum and a reduction in background turbulence level both at and upstream of impingement. Development of the flow down-stream of the impingement edge of the cavity is characterized by a decrease in the maximum value of total turbulence intensity and drastic variations in shapes of the mean velocity and turbulence intensity distributions of the boundary layer. Flow visualization at lower speeds suggests that these characteristics are associated with the distortion of large scale vortical structures convected along the wall downstream of impingment. (Sims-ISWS)
W80-00972

EXPERIMENTS IN LONGITUDINAL DISPERSION WITH DEAD ZONES,
Ministry of Works and Development, Wellington (New Zealand).
E. M. Valentine, and I. R. Wood.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY8, Proceedings Paper 14790, p 999-1016, August 1979. 11 Fig, 1 Tab, 22 Ref, 2 Append.

Descriptors: *Dispersion, *Open channel flow, *Turbulent flow, Laboratory tests, Hydraulic models, Numerical analysis, Mathematical models, Solutes, Flow, Rivers, Stream-flow, Turbulence, Hydraulics, Dead zone.

A series of laboratory experiments was reported which lent support for the need to consider the effects of dead zone trapping on the longitudinal dispersion process in natural streams. This may offer an explanation for the apparent non-applicability of Taylor's theory in some rivers. The results of an experiment devised to test the 'frozen cloud' hypothesis with dead zones were presented. Experiments showed an increase in the dispersion coefficient and delay in arrival at the diffusive

period due to the presence of dead zones. These results were used to verify a two-dimensional computer solution which has been previously reported by the authors. (See also W78-00075) (Sims-ISWS)
W80-00973

MEASUREMENTS IN INTERSECTING SUBMERGED AND INDUCED JETS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W80-00977

HYDRAULICS OF CLOSED CONDUIT SPILLWAYS, PART XVII: THE TWO-WAY DROP INLET WITH A SEMICYLINDRICAL BOTTOM,
Science and Education Administration, Minneapolis, MN. St. Anthony Falls Hydraulic Lab.
K. Yalamanchili, and F. W. Blaisdell.
Report AAT-NC-2, May 1979. 27 p, 10 Fig, 3 Tab.

Descriptors: *Spillways, *Laboratory tests, *Model studies, *Head loss, Flow, Flow characteristics, Hydraulic structures, Analysis, Hydraulics, Closed conduits, Hydraulic design, Energy loss, Pipe flow, Closed conduit spillways, Pressure coefficients, Head loss coefficients.

This report presented the results of experiments on two-way drop inlets with semicylindrical bottom for closed conduit spillways. The two-way drop inlet is a rectangular drop inlet having a width equal to the barrel diameter, a bottom semicircular in cross section, and a flat, horizontal antivortex plate supported above the drop inlet crest by extensions of the drop inlet endwalls. Two types of barrel entrances, referenced as A and B, were tested. In the type A entrance, the horizontal bottom of the drop inlet extended into the barrel beyond the downstream endwall where a vertical elbow changed the slope from horizontal to that of the barrel. In the type B entrance, the bottom of the drop inlet had the same slope as the barrel. Spillway performance of the type A entrance was described for several drop inlet heights, drop inlet lengths, and antivortex plate heights. For both types of entrances, effects of the midheight piezometer location, drop inlet length, antivortex plate height, and barrel slope on the crest loss, barrel entrance loss, and pressure coefficients for two-way drop inlets with semicylindrical bottoms were presented. Equations for computing the barrel entrance loss coefficients and the pressure coefficients on the barrel crown near the barrel entrance were developed, and their precision was discussed. A method for computing the entrance loss coefficients was described. A summary of recommendations presented criteria for determining the drop inlet dimensions for the type A entrance and listed the equations for computing the energy loss coefficients--crest loss, barrel entrance loss, and total entrance loss coefficients--and pressure coefficients. (Humphreys-ISWS)
W80-01011

MODELING IN DESIGN OF PUMPING PITS,
Utah Water Research Lab., Logan; and Colorado State Univ., Fort Collins. Engineering Research Center.
J. P. Tullis.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14812, p 1053-1063, September 1979. 1 Fig, 28 Ref, 1 Append.

Descriptors: *Pumping, *Model studies, *Hydraulic models, *Mathematical models, Flow, Vortices, Pumps, Draft tubes, Hydraulic design, Hydraulic equipment, Hydraulics, Hydraulic engineering.

Hydraulic model studies of pumping pits will continue to be an important part of the design process. Even though many studies have been completed, design criteria are not available that insure trouble-free operation of the pump. The paper discussed the role of modeling in the design of pumping pits and suggested methods for making them more effective. Included was a description of the various hydraulic problems uncovered by past studies and successful solutions that have been developed. The article was not a technical state-of-the-art paper, but it did include several references to recent papers on the subject. (Sims-ISWS)
W80-01019

RADIAL HYDRAULIC JUMP,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
A. M. Khalifa, and J. A. McCorquodale.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14825, p 1065-1078, September 1979. 12 Fig, 9 Ref, 2 Append.

Descriptors: *Hydraulic jump, *Energy dissipation, *Model studies, Mathematical models, Theoretical analysis, Hydraulic models, Laboratory tests, Settling basins, Flow, Froude number, Energy, Radial gates, Air entrainment, Hydraulic structures, Hydraulic, *Radial hydraulic jump.

Radial hydraulic jump occurs in a stilling basin with diverging side walls. Experimental data were used to obtain the free-surface profiles and the floor-pressure profiles within the diverging basin. These profiles were used to develop generalized equations for the effective side wall forces for Froude numbers from 2 to 10. The momentum equation, which involves these forces, was then applied to develop an equation for the sequent depth ratio for the jump. For Froude numbers above 3, the sequent depth ratio was shown to be less than that for the rectangular jump. The length of the radial jump was about 70% of the length of a rectangular jump for the same initial Froude number. However, the volume of the jump was approximately the same as for the rectangular jump. The energy dissipation in the radial jump was approximately 15% greater than for the rectangular jump. (Sims-ISWS)
W80-01020

UNCONDITIONAL STABILITY IN CONVECTION COMPUTATIONS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce, Y. H. Chen, and D. B. Simons.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14807, p 1079-1086, September 1979. 3 Fig, 2 Tab, 4 Ref, 2 Append.

Descriptors: *Convection, *Stability, *Model studies, Mathematical models, Numerical analysis, Theoretical analysis, Diffusion, Dispersion, Linear programming, Equations, Circulation, Water circulation, Viscosity, Mathematics, Mathematical studies, Convergence.

A theoretical treatment of the numerical properties of a class of explicit schemes of the pure convection equation was presented. The von Ne umann and Hirt analyses were used to show that unconditional stability and second-order accuracy are both possible within the framework of an explicit formulation. Three unconditionally stable and second-order accurate explicit schemes were presented. In two of them, the weighing factors vary in time and space as a function of the local Courant number. (Sims-ISWS)
W80-01021

8C. Hydraulic Machinery

PROCESS FOR ACTUATING A HYDRAULIC PRIME MOVER THROUGH CONVERSION OF ENERGY IN WATER CURRENT,
H.-H. Meng.
U.S. Patent No 4,156,347, 11 p, 19 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 982, No 5, p 1590, May 29, 1979.

Descriptors: *Patents, *Energy conversion, *Currents(Water), Ocean currents, Kinetics, Pistons, Hydraulic equipment.

The object is to provide a process for actuating a hydraulic engine in which the kinetic energy of running water in an ocean, sea or river is absorbed through a working medium of an elastic substance. The kinetic energy of the water is stored as potential energy by the elastic substance with the elastic substance then being positioned so that the absorbed energy can be released. The stored potential energy is converted back into kinetic energy for driving a hydraulic engine. The arrangement for carrying out the process comprises at least one set of three coaxially disposed pipes. The central or main pipe serves as a cylinder to receive the impulses of the water current while the two sleeve pipes serve for bypassing the main pipe. A complex piston consisting of a chamber containing an elastic working substance and provided with a conventional piston is slidable in the cylinder and connected to an engine crankshaft. Valve and lock means are provided to regulate movement of the piston so that the kinetic energy can first be absorbed and stored as potential energy and later released to actuate the engine. (Sinha - OEIS)
W80-00904

8D. Soil Mechanics

DISPERSIVE SOIL PROBLEM AT LOS ESTEROS DAM,
Army Engineer District, Albuquerque, NM.
T. N. McDaniel, and R. S. Decker
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol 105, No GT9, Proceedings Paper 14804, p 1017-1030, September 1979. 5 Fig, 3 Tab, 6 Ref, 1 Append.

Descriptors: *Soil tests, *Earth dams, *Clays, *New Mexico, Laboratory tests, Dispersion, Soil stabilization, Dams, Filters, Sands, Test procedures, Analysis, Soil mechanics, Dam construction, Impervious soils, Erosion control, Soil amendments, Lime, Dam design, *Los Esteros Dam(NM), Piping, Impervious cores, Dispersive soils, Sand filters.

Dispersive soil was discovered in the impervious borrow area at Los Esteros Dam, and through the use of sand filters and lime treatment of specific areas, the dispersive soil was used in the impervious core of the dam. Testing of the soil at the first laboratory was inconclusive, but testing at the second confirmed the soil to be dispersive. Tests were then conducted on the dispersive soil, sand filters, and lime-treated dispersive soil to determine whether sand filters and lime treatment could be used to control and alter the dispersive clay for use in the impervious core of the dam. Results of the program confirmed that a properly graded sand filter will control dispersive erosion through the impervious core, and that lime treatment alters the soil to a nondispersive material. A sand filter was constructed downstream of the impervious core, and, where based of the impervious core is founded on a fractured sandstone, a 5-ft thick layer of the core was treated with lime. (Humphreys-ISWS)
W80-00974

9. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

UPTAKE OF METHOXYCHLOR FROM FOOD AND WATER BY THE AMERICAN TOAD (BUFO AMERICANUS),
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A
W80-01102

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ECONOMICS OF WEATHER MODIFICATION: A REVIEW,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 6B.
W80-01008

HYDROMETEOROLOGICAL CHARACTERISTICS OF SEVERE RAINSTORMS IN ILLINOIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2B.
W80-01009

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 4
FEBRUARY 15, 1980

W80-01201--W80-01600
CODEN: SWRABW

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 4
FEBRUARY 15, 1980

W80-01201--W80-01600

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

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Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

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09 MANPOWER, GRANTS, AND FACILITIES

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

PORTABLE WATER SAMPLING APPARATUS,
UOP Inc., Des Plaines, IL. (Assignee).
E. N. Colburn.
U.S. Patent No 4,160,622, 4 p, 3 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 380, July 10, 1979.

Descriptors: *Patents, *Sampling, *On-site tests, Water wells, Water pollution, Equipment, Portable equipment.

A portable, self-powered water pumping apparatus for use in sampling water in remotely located wells comprises a pair of integrally connected, side-by-side, long flexible plastic tubes which may be wound around a reel which is preferably mounted for rotation on a mobile cart and which can be manually moved. When the lower ends of the tubes are well submerged beneath the water level in a well, admission of gas to the smaller tube at its upper end will force water which enters the larger tubing in the annular space surrounding the metal tubing up through the larger tube and out the upper end so that it can be collected. To facilitate the insertion of the extruded tubing into a well from the coil in which it is stored, the tubing is formed of a plastic such as a vinyl and acetate modified polyethylene which has a memory and which is flexible at low temperatures. (Sinha-OEIS)
W80-01479

CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77, VOLUME I, DES PLAINES RIVER BASIN AND LAKE MICHIGAN,
Geological Survey, Champaign, IL. Water Resources Div.
D. Grason, and R. W. Healy.
Available from National Technical Information Service, Springfield, VA 22161 as PB-299 912, Price codes: A10 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-23, 1979, 218 p, 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Illinois, *Water quality, *Surface waters, *Chemical analysis, *Water temperature, Sampling, Sites, Water analysis, Streamflow, Flow rates, Lake Michigan, *Des Plaines River basin(IL).

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume I includes the Des Plaines River basin and Lake Michigan. (Woodard-USGS)
W80-01584

CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77, VOLUME II, ILLINOIS RIVER BASIN AND MISSISSIPPI RIVER TRIBUTARIES NORTH OF ILLINOIS RIVER BASIN,
Geological Survey, Champaign, IL. Water Resources Div.
D. Grason, and R. W. Healy.
Available from National Technical Information Service, Springfield, VA 22161 as PB-299 913, Price codes: A13 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-24, 1979. 282 p, 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Illinois, *Water quality, *Surface waters, *Chemical analysis, *Water temperature, Sampling, Sites, Water analysis, Streamflow, Flow rates, *Illinois River basin, *Mississippi River tributaries north of Illinois River basin.

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume II includes the Illinois River basin and Mississippi River tributaries north of Illinois River basin. (Woodard-USGS)
W80-01585

CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77, VOLUME III, OHIO RIVER TRIBUTARIES AND MISSISSIPPI RIVER TRIBUTARIES SOUTH OF ILLINOIS RIVER BASIN,
Geological Survey, Champaign, IL. Water Resources Div.
D. Grason, and R. W. Healy.
Available from National Technical Information Service, Springfield, VA 22121 as PB-299 914, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-25, 1979. 242 p, 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Illinois, *Water quality, *Surface waters, *Chemical analysis, *Water temperature, Sampling, Sites, Water analysis, Streamflow, Flow rates, *Ohio River tributaries south of Illinois River basin, *Mississippi River tributaries south of Illinois River basin.

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume III includes Ohio River tributaries and Mississippi River tributaries south of Illinois River basin. (Woodard-USGS)
W80-01586

1B. Aqueous Solutions and Suspensions

DISSOLUTION KINETICS OF SILICATE ROCKS--APPLICATION TO SOLUTE MODELING,
Geological Survey, Denver, CO. WAter Resources Div.
A. F. White, and H. C. Claassen.
In: Chemical Modeling in Aquious Systems, Speciation, Sorption, Solubility, and Kinetics; ACS Sympsoium Series 93: American Chemical Society, Washington, District of Columbia, p 447-473, 1979. 10 Fig, 3 Tab, 32 Ref.

Descriptors: *Water chemistry, *Solubility, *Rocks, *Silicates, *Geochemistry, Groundwater, Reviews, Evaluation, Speciation, Sorption, Kinetics, Hydrogen ion concentration, Ion transport, Diffusion, Adsorption, Chemical reactions, Dissolved solids, *Chemical modeling, *Dissolution, Diffusion coefficient.

Silicate minerals comprise more than 75 percent of the rocks with which ground water comes in contact. Quantitative knowledge of the weathering rates of these minerals could provide an importan means of estimating the total residence time a water has been in contact with a given silicate rock, the effective surface area of the aquifer, and other information pertinent in defining a given hydrogeologic system. Workers have experimented to define the dissolution rates of silicate minerals. This paper briefly reviews the types of reaction rates that have been observed, followed by more detailed discussion concerning the dependence of these rates on constituents in the aqueous media, and the implications for solute modeling. (Woodard-USGS)
W80-01600

2. WATER CYCLE

2A. General

EFFECTS OF SUBURBAN CONSTRUCTION ON RUNOFF CONTRIBUTING ZONES IN A SMALL SOUTHERN ONTARIO DRAINAGE BASIN,
Trent Univ., Peterborough (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W80-01272

PROBABILITY ANALYSIS OF HISTORICAL FLOOD DATA,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01279

THE RESULTS OF TEN YEARS' EXPERIMENTAL STUDY ON PLYNLIMON, MID-WALES, AND THEIR IMPORTANCE FOR THE WATER INDUSTRY,
Institute of Hydrology, Wallingford (England).
M. D. Newson.
Journal of the Institution of Water Engineers and Scientists, Vol 33, No 4, p 321-333, July 1979. 3 Fig, 3 Tab, 28 Ref.

Descriptors: *Demonstration watersheds, *Water yield, *Land use, *Water balance, On-site investigations, Watersheds(Basins), Forests, Grasslands, Hydrological cycle, Hydrology, Precipitation(Atmospheric), Streamflow, Instrumentation, Water loss, Evapotranspiration, Runoff, Water quality, Foreign research, *Plynlimon(Wales).

The initial objectives of the study were to determine: (1) whether annual water yields from catchments under forest and hill pasture differed; and (2) whether afforestation affected the timing and magnitude of flood flows. Provisional results from the Institute's Coal Burn catchment, in Cumbria, indicated that peak flows are increased by drainage prior to affor estation and while the trees are small. Peak runoff for a sample of Plynlimon floods, however, shows an average reduction of peak flows by the mature forest of the Severn (to 66% of those of the Wye). Times-to-peak analyzed for the Flood Study average 2.3 h r in the Severn and 2 hr in the Wye, although there was a faster response by the Severn in the case of a sub-sale restricted to identical rainstorm inputs. The Plynlimon experiment has made the following conclusions concerning upland hydrometric practice over the last 10 years: (1) There is no complete answer to the problems of measuring mountain precipitation. The ground-level raingage is essential for rainfall measurements in exposed sites, but it has disadvantages during snow, as does the canopy-level raingage. (2) Streamflow measuring devices need very careful maintenance; field calibration is often essential. (3) Measurements of storage and potential evapotranspiration are the least problematic in operational terms at Plynlimon. (4) All instrument systems in a difficult environment require a period of field trial, accompanied by observers and maintenance staff on the spot. (5) Studies of process, nested within a catchment experiment, require intensive staffing but can often make use of very simple techniques over short periods. They are essential to add the understanding necessary to confirm and extrapolate water balance findings. The Plynlimon study clearly has a number of continuing roles: (1) To examine every aspect of the results gathered so far on water yields, with a view to extrapolating them to other catchments and to complement them with a detailed study of the flood hydrograph under grassland and forestry. (2) To maintain the investment at Plynlimon itself in good quality upland hydrometric data, and to make further progress in instrumentation until the next important change in cropping--the felling of Hafren forest. (3) To match the increasing interest in water quality in hitherto unpolluted upland

sources by further studies of land erosion and nutrient runoff. (Humphreys-ISWS)
W80-01290

A SYSTEM FOR REGIONAL ANALYSIS OF WATER AVAILABILITY,
Oak Ridge National Lab., TN.
J. S. Jalbert, and A. D. Shepherd.
Available from the National Technical Information Service, ORNL-NOREG-TM 82, Price codes: A08 in paper copy, A01 in microfiche. Report No ORNL/NUREG/TM-82, July 1977. 165 p, 1 Fig, 8 Ref, 3 Append. W-7405-eng-26.

Descriptors: *Available water, *Regional analysis, *Powerplants, *United States, *Maryland, Analysis, Stream gages, Model studies, Computers, Data storage and retrieval, Reservoirs, Flow, Streamflow, Low flow, Data processing, Computer programs, Water resources development, Evaporation, Regional analysis systems, Powerplant siting.

The Water Analysis System (WAS) has been developed in response to the high priority given water availability analysis in power plant siting. WAS is a composition of main programs and subroutines that process streamflow information from the U.S. Geological Survey DAILY-VALUE water tapes, which contain data for all stream gaging stations in the United States. The WAS programs enable the user (1) to delimit any region of the United States by state, county, size of drainage area, or latitude-longitude frame; (2) to recall daily flow values from the USGS water tapes for all gaging stations within the study region; (3) to compute low flow recurrence frequencies and apply theoretical probability distributions; and (4) to predict the reservoir drawdown capacity necessary to maintain any given rate of streamflow at any specified rate of consumption. The WAS procedure provides a valuable tool for energy facility siting in particular and is directly applicable to many water resource questions. (Froehlich-ISWS).
W80-01295

WATER RESOURCES OF SHALLOW AQUIFERS IN THE UPPER POPLAR RIVER BASIN, NORTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. D. Feltis.
Geological Survey Water-Resources Investigations 79-51 (open-file report), June 1979. 23 p, 3 Fig, 2 Plates, 5 Tab, 6 Ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Hydrogeology, *Water quality, *Surface-groundwater relationships, Water wells, Groundwater movement, Groundwater recharge, Streamflow, Water analysis, Chemical analysis, Water types, Hydrologic data, Montana, *Upper Polar River basin(MT), Glacial geology.

The aquifer system studied in the upper Popular River basin in Montana ranges in age from Late Cretaceous to Holocene. Most wells obtain water from the Paleocene Fort Union Formation or younger rocks. The potentiometric surface of the Fort Union and overlying rocks indicates movement of water from the high interstream areas toward principal stream valleys. Recharge is principally through sand and gravel deposits of the Flaxville Formation, which occur as large terrace remnants, and the Wiota Gravel. Water in these formations locally recharges the underlying Fort Union Formation. Water in the gravel also emerges around the edge of the terraces as seeps and springs. Water samples from wells tapping the aquifers are of the sodium bicarbonate, magnesium bicarbonate, or calcium bicarbonate type. The range in dissolved-solids concentration for the various aquifers is: Fox Hills-Hell Creek aquifer, 940 to 1,300 mg/L; Fort Union Formation, 520 to 1,470 mg/L; glacial outwash deposits, 570 to 770 mg/L, and alluvium, 880 to 1,490 mg/L. The dissolved-solids concentration of one water sample from the Flaxville Formation was 400 mg/L. Seepage measurements of the Poplar River and East Fork Poplar River from the international boundary to the south edge of the study area in October 1977 showed a net gain of 2.84 cubic feet per second from a total flow of 11.7 cubic feet per second. This gain is discharge of water from the alluvium to the rivers. (Woodard-USGS)
W80-01422

WATER RESOURCES DATA OF THE SEWARD AREA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 6D
W80-01427

PROGRESS REPORT ON WATER RESOURCES OF THE TULALIP INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost.
Geological Survey Water-Resources Investigations 78-31 (open-file report), 1979. 39 p, 14 Fig, 1 Plate, 8 Tab, 8 Ref.

Descriptors: *Water resources, *Evaluation, *Indian reservations, *Water quality, Streamflow, Flow rates, Lakes, Water levels, Aquifer characteristics, Water wells, Water yield, Hydrogeology, Groundwater recharge, Water level fluctuations, Tidal effects, Chemical analysis, Nutrients, Washington, *Tulalip Indian Reservation(WA).

Updated information on the Tulalip Indian Reservation's resources indicates that the newly developed tribal well field yielded about 100 million gallons of water during August 1975-October 1976. At 16 or 17 streamflow sites, mean annual discharges during the 1976 water year exceeded those of the 1975 water year by a median value of 25 percent. The levels of John Sam, Ross, and Weallup Lakes rose from 0.6 to 1.0 feet during the period October 1974-October 1976; the increase in volume stored in the three lakes was about 14.5 million gallons. The quality of surface water sampled was generally good. Nitrite and total-nitrogen concentrations tended to be greater during periods of high streamflow than during periods of low flow, whereas total-phosphorus concentrations tended to show the opposite relationship. (Woodard-USGS)
W80-01435

MOVING BOUNDARY NUMERICAL SURGE MODEL,
Oak Ridge National Lab. TN.
For primary bibliographic entry see Field 2L.
W80-01456

2B. Precipitation

A STATISTICAL TECHNIQUE FOR DETERMINING RAINFALL OVER LAND EMPLOYING NIMBUS 6 ESMR MEASUREMENTS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 7B.
W80-01262

CHLORINE, BROMINE AND IODINE IN MONSOON RAINS IN INDIA,
Bhabha Atomic Research Centre, Bombay (India). Air Monitoring Section.
For primary bibliographic entry see Field 2K.
W80-01291

A CLIMATOLOGY OF MOUNTAIN FOG ON MAUNA LOA, HAWAII ISLAND,
Univ. Hawaii Honolulu, Water Resources Research Center.
J. O. Juvik, and P. C. Ekern.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118805. Price Codes: A04 in paper copy, A01 in microfiche. Technical Report No. 118, June 1978. 70 p, 28 Fig, 10 Tab, 3 Plates, 27 Ref. OWRT A-041-HT(2), 14-34-0001-5011.

Descriptors: *Clouds, *Fog, *Water balance, *Mountains, *Climatology, Effects, Ecosystems, Hawaii, *Fog regime, *Fog rainfall equivalent, Louvered fog gage, Fog gage network, Mauna Loa(Hawaii).

This study of the mountain cloud and fog regimes on the windward and leeward slopes of Mauna Loa, Hawaii Island (1) develops a standardized louvered-screen, fog catchment gage: (2) develops and indirect approximation method for estimating average droplet sizes during precipitation episodes and for separating the rainfall and fog components; (3) establishes an extensive fog sampling network on the windward and leeward slopes of Mauna Loa; and (4) develops an original computer program for detailed temporal and spatial analyses of rainfall, fog, and wind parameters. An analysis of data for the 1974 to 1976 period yielded the following conclusions: (1) a well-defined fog belt exists on windward Mauna Loa in the altitudinal zone between 1 500 to 2 500 m with fog-catchment amounts as great as one-half the rainfall, or about 750 mm; (2) mountain fog on leeward Mauna Loa increases with elevation up to a least 2 000 m, with fog amounts equivalent to one-fourth the rainfall, or about 250 mm; (3) seasonal and altitudinal patterns in fog frequence and catchment amounts are related to the dynamic interaction of the tradewind field (particularly the tradewind inversion) and the local land/sea breeze regime; (4) mountain fog appears to be a significant factor in the water balance of mountain ecosystems on Mauna Loa; and (5) the potential for large-scale mechanical recovery of fog water may exist for selected locations on Mauna Loa.
W80-01375

THE REMOVAL OF ORGANIC SURFACE FILMS BY RAIN,
Wisconsin Univ. Madison. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2H.
W80-01543

2C. Snow, Ice, and Frost

MICROCLIMATE IN FISHPOND LITTORAL ECOSYSTEMS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2H.
W80-01218

ANISOTROPIC PROPERTIES OF SEA ICE IN THE 50- TO 150-MHZ RANGE,
Army Terrestrial Sciences Center, Hanover, NH.
A. Kovacs, and R. M. Morey.
Journal of Geophysical Research, Vol 84, No C9, p 5749-5759, September 20, 1979. 14 Fig, 3 Tab, 4 Ref.

Descriptors: *Sea ice, *Anisotropy, *Radar, Onsite investigations, Ice, Physical properties, Electromagnetic waves, Currents(Water), Equipment, Measurement, Data processing, Cold regions, Brines, Ice-brine systems, C-axis.

Results of impulse radar studies of sea ice near Prudhoe Bay, Alaska, showed that where there is a preferred current direction under the ice cover, the crystal structure of the ice becomes highly ordered. This includes a crystal structure with a preferred horizontal c axis that is oriented parallel with the local current. The radar studies showed that this structure behaves as an anisotropic dielectric. The result was that when electromagnetic energy is radiated from a dipole antenna in which the E field is oriented perpendicular with the c axis azimuth, no bottom reflection is detected. It was also found that the frequency dispersion of anisotropic sea ice varies in the horizontal plane. This was demonstrated by the center frequency of the reflected signal spectrum, which is maximum in the preferred c axis direction and minimum perpendicular to it. In addition, it was found that the frequency dispersion is related to the average bulk brine volume of the ice, but that the bulk dielectric constant of the ice, as determined from impulse travel time, shows little correlation with the coefficient of anisotropy. (Sims-ISWS)

W80-01278

GROUND FREEZING,
Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, April 1979. 558 p, H. S. Jessberger, Editor. Published by Elsevier Scientific Publishing Company, Amsterdam (The Netherlands).

Descriptors: *Frozen ground, *Porous media, *Frost, *Conferences, *Soil dynamics, Freezing, Laboratory tests, Theoretical analysis, Analytical techniques, Heat transfer, Mass transfer, Model studies, Physical properties, Mathematical studies, Thawing, Seepage, Frost action, Shear, Permeability, On-site investigations, Instrumentation, Equipment, Refrigeration, Frost heaving, Excavation, Tunneling, Thermophysical properties.

This symposium was arranged to provide an exchange of information of a scientific and technical nature about engineering with frozen soils as well as on related frost research problems. The Symposium was divided into three sessions: (1) Phase transformation of water, thermodynamic aspects, heat and mass transfer, mathematical models, and laboratory and theoretical studies of thermophysical properties. (2) Strength and creep characteristics, material behavior under sustained load, rheological and mathematical studies, properties of freezing and thawing ground as dynamic properties, thaw consolidation, shear resistance, and permeabilities at the thawing interfaces, cyclic freezing. (3) Design and calculation of frozen soil-structures, case histories: tunnelling, excavations, shafts, seepage cutoffs, frost heave aspects, calculation and dimensioning of refrigeration plants, freezing pipes, means of monitoring frost penetration, methods and instrumentation for determining the locations of boundaries of frozen soils. (See W80-01499 thru W80-01537). (Humphreys-ISWS)
W80-01498

EFFECTS OF TEMPERATURE AND PRESSURE ON FROST HEAVING,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
E. Penner, and T. Walton.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 29-39, April 1979. 7 Fig, 1 Tab, 3 Ref.

Descriptors: *Frost heaving, *Saturated soils, *Frost, *Laboratory tests, Freezing, Ice, Soils, Temperature, Analysis, Frost action, Overburden, Pressure, Methodology, Ice accumulation.

Concerning the influence of overburden pressure on the relation between rate of heave and cold-side temperature, studies show that the heave rate for various overburden pressures tends to converge as the cold-side temperature is lowered, and the maximum rates of ice accumulation at low pressures occur at temperatures closer to O C than do those at high pressures. Evidence was also presented that a heaving zone is involved in frost action rather than a freezing plane. This zone extends over an increasingly greater temperature range and distance as the overburden pressure is increased. Using the concept of a heaving zone leads to a method for calculating the heave-decrease curve. The period of heave decrease is marked by a rapidly increasing ice segregation ratio and a reduced frost-penetration rate. The two soils used in these experiments were a Mackenzie Valley soil (MVS 4) with a clay size content of 23%, 72% silt size, and 5% sand, and Leda clay consisting of 80% clay size particles, and the remainder in the silt size. (See also W80-01498) (Humphreys-ISWS)
W80-01499

EFFECTS OF INITIAL SOIL-WATER CONDITIONS ON FROST HEAVING CHARACTERISTICS,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
S. Kinosita.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 41-52, April 1979. 6 Fig, 2 Tab, 5 Ref.

Descriptors: *Frost heaving, *On-site tests, *Soil water, *Soils, Temperature, Frost action, Melting, Freezing, Soil water movement, Foreign research, Moisture content, Water table, Cores, Analysis, On-site investigations, *Japan, Frost penetration.

Frost heavings have been observed on the soils in waterproof basins (four basins denoted by A,B,C, and D) at the Tomakomai field site, Hokkaido, Japan. Basins A, B, and C were filled with the same silty soil, and Basin D was filled with four layers, namely, pebbles (0-5 cm below the surface), a mixture of pebbles and silty soil (5-20 cm) silty soil (20-60 cm), and sand (60-160 cm). In the winter of 1976-77, water levels in the basins were set at the levels of the ground surface in A, 40 cm below the surface in B, the bottom in C, and 30 cm below the surface in D. Basin C had no free groundwater. The highest surface heave was 32 cm in A, 26 cm in B, 19 cm in C, and 14 cm in D. A water supply from the free groundwater toward the freezing front extended over 220 cm through the silty soil, but was limited to 63 cm through the sand. The migration speeds of the soil water supplied from the unfrozen part were calculated for A, B, and C from the measurements of their volumetric water-content profiles. The migration speed of soil water from the unfrozen layer was larger in the early part of the winter; it corresponded to the existence of dense ice lenses in the upper part of the frozen layer. (See also W80-01498) (Humphreys-ISWS)
W80-01500

FROST HEAVE OF UNSATURATED LOAMY SOIL UNDER FIELD CONDITIONS,
Leningrad Inst. of Constructional Engineers (USSR).
V. D. Karlov.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 53-62, April 1979. 6 Fig, 5 Tab, 3 Ref.

Descriptors: *Frost heaving, *Soils, *On-site investigations, *Glacial soils, Loam, Freezing, Thawing, Movement, Soil physical properties, On-site tests, Soil mechanics, Frost action, Deformation, Heaving, Foreign research, Moisture content, *USSR.

A study on the heaving properties of morainal loamy soil was carried out under field conditions on two grounds. The loamy soils with broken structures were situated in the form of embankments of different density on the first ground. On the second ground, the heave of the morainal loamy soil with unbroken structure was investigated. On this ground, concrete foundations were laid 1 X 1 m in size and with pressures at the foot of 0.005 MPa, 0.025 MPa, 0.05 MPa, and 0.1 MPa. Besides, some foundations were placed on the surface, and the foot of the others was 0.5 m below the surface of the ground. The intensity of the heave of the morainal loamy soils was determined by the value of volumetrical moisture. Migration of moisture took place from thawed layers situated below to the boundary of freezing during the whole period of freezing. The increase of the external pressure upon the foundation (up to 0.1 MPa) did not result in a decrease of displacements of the most loaded foundations. The deformations of the foundation during its freezing and thawing in the limits of the foot of one foundation were relatively nonuniform. The relative deformation foundation value at maximal freezing ranged from 0.0014 to 0.014. During the thawing of the freezing loamy soil, the relative deformation of the foot of experimental foundations ranged from 0.002 to 0.048. During the thawing, the largest nonuniformity of the sediment corresponded to the most loaded foundations. The distribution of the loamy soil heave value in the limits of the experimental ground may be considered subjected to the normal law of distribution. (See also W80-01498) (Humphreys-ISWS)
W80-01501

EFFECT OF THE RATE OF HEAT REMOVAL ON THE RATE OF FROST HEAVING,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
K. Horiguchi.
In: Ground Freezing: Proceedings of the First International Sympsoium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 63-71, April 1979. 7 Fig, 11 Ref.

Descriptors: *Frost heaving, *Freezing, *Porous media, *Heat flow, Laboratory tests, Testing procedures, Heat balance, Rates, Soil physical properties, Analysis, Heaving, Zeolites, Measurement, Carborundum, Instrumentation, Cation exchange, Frost heaving rates, Alpha-alumina.

Relations between the rate of frost heaving and the rate of heat removal from the freezing front were examined under the following conditions. While the temperature of the unfrozen part of a sample saturated with water was kept at nearly 0 C throughout an experiment, the temperature of a coolant was reduced automatically at the rate of 4.5C/h. In order to lessen the experimental error in the measurement of the quantity of heat, a heat flux at the surface of the sample was taken greater than that in the field. The rate of heat removal was measured by a heat-flow meter. Powder materials used were alpha-alumina, carborundum, Linde zeolites A and X, whose exchangeable cations were exchanged by other cations. The following results were obtained: (1) As the rate of heat removal from the freezing front increased, the rate of frost heaving increased, reached the maximum, and then decreased. (2) This maximum rate increased as the particles were reduced in size, while in the cases of Linde zeolites A and X, having the same particle size, this maximum rate depended on the kinds of exchangeable cations. (See also W80-01498) (Humphreys-ISWS)
W80-01502

EFFECT OF FREEZING AND THAWING ON THE PERMEABILITY AND STRUCTURE OF SOILS,
Army Terrestrial Sciences Center, Hanover, NH.
E. J. Chamberlain, and A. J. Gow.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 73-92, April 1979. 20 Fig, 1 Tab, 11 Ref.

Descriptors: *Soil structure, *Permeability, *Freezing, *Thawing, Laboratory tests, Soils, Soil types, Laboratory equipment, Frost action, Frost, Frozen soils, Fracture permeability, Soil science, Freezing effects.

The permeability and structure of 4 fine-grained soils were observed to be changed by freezing and thawing. In all cases, freezing and thawing caused a reduction in void ratio and an increase in vertical permeability. The increase in permeability was attributed to the formation of polygonal shrinkage cracks and/or to the reduction of the volume of fines in the pores of the coarse fraction, the mechanism controlling the process depending on material type. No definite relationships were established; however, it appears that the largest increase in permeability occurs for the soil of highest plasticity. (See also W80-01498) (Sims-ISWS)
W80-01503

SEGREGATION FREEZING AS THE CAUSE OF SUCTION FORCE FOR ICE LENS FORMATION,
Army Terrestrial Sciences Center, Hanover, NH.
S. Takagi.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 93-100, April 1979. 3 Fig, 20 Ref.

Descriptors: *Freezing, *Soils, *Frozen soils, *Ice, Pore water, Soil moisture, Model studies, Mathematical models, Numerical analysis, Analytical techniques, Soil science, Suction forces, Ice lenses.

A new freezing mechanism, called segregation freezing, was proposed to explain the generation of the suction force that draws pore water up to the freezing surface of a growing ice lens. The segregation freezing temperature was derived by applying thermo-dynamics to a soil mechanics concept that distinguishes the mechanically effective pressure from the mechanically neutral pressure. The frost-heaving pressure was formulated as part of the solution of the differential equations of the simultaneous flow of heat and water, of which the segregation freezing temperature was one of the boundary conditions. (See also W80-01498) (Sims-ISWS)
W80-01504

EQUATIONS OF FROST PROPAGATION IN UNSATURATED POROUS MEDIA,
Laboratoire Central des Ponts et Chaussees, Paris (France).
J. M. Menot.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 101-109, April 1979. 3 Fig, 3 Ref.

Descriptors: *Frost, *Frozen soils, *Frozen ground, *Porous media, *Model studies, Mathematical models, Equations, Energy, Soil moisture, Temperature, Capillary action, Darcys law, Mathematics, Freezing, Frost propagation.

The equations of soil freezing were established where the soil is partially water saturated, i.e., when it contains air. A macroscopic viewpoint was chosen using leveled parameters (averages on a 'small' volume surrounding the considered point). It was assumed that water can exist at a temperature below 0 C. Mechanical energy (kinetic energy and power of inner forces) was neglected with respect to thermal energy; radiation was also neglected. The establishment of the equations was based upon the expression (1) of the mass and energy conservation laws; and (2) of constitutive laws such as Fourier's law, Darcy's law, the curve of capillary pressure in terms of the saturation degree, etc. A system of nonlinear partial differential equations was obtained with a free surface; the unknowns were the temperature, the saturation degree, and the water pressure at each point and at each time; these unknowns were coupled in the differential equations. (See also W80-01498) (Sims-ISWS)
W80-01505

THE EFFECT OF ITERATION FREQUENCY ON A NUMERICAL MODEL OF NEAR-SURFACE ICE SEGREGATION,
Michigan Univ., Ann Arbor. Dept. of Geography.
S. I. Outcalt.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4 p 111-124, April 1979. 6 Fig, 3 Tab, 10 Ref.

Descriptors: *Ice, *Frozen soils, *Frozen ground, *Model studies, Mathematical models, Numerical analysis, Equations, Soil water, Soil moisture, Freezing, Temperature, Water vapor, Frost, Analytical techniques.

It is possible to construct numerical models of the ice segregation process. Reported herein was a model which was a discrete approximation of a nonlinear continuous process and thus was subject to somewhat more pronounced effects of node geometry and calculation frequency than linear models. The model more closely simulated natural frozen soil structure when vapor phase transport was included in the model structure. An iteration frequency of 10 s appeared sufficient to yield realistic results with the exponentially spaced node geometry employed in these tests. (See also W80-01498) (Sims-ISWS)
W80-01506

CRYOGENIC TEXTURE AND STRENGTH ASPECTS OF ARTIFICALLY FROZEN SOILS,
Rutgers-The State Univ., New Brunswick, NJ. Dept. of Civil and Environmental Engineering.
A. R. Jumikis.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 125-135, April 1979. 5 Fig, 22 Ref.

Descriptors: *Freezing, *Frozen soils, *Cofferdams, Soil texture, Soil strength, Soil treatment, Frozen ground, Construction, Structures, Civil engineering, Cryogenics, Soil properties, Soil water, Groundwater, Ice, Crystals, *Artificial soil freezing.

This paper elucidated some factors affecting the formation of soil cryogenic textures upon artificial active and passive soil freezing to form a soil-ice wall cofferdam. Depending upon the soil type, the thermal regimen of the stages of active and passive freezing of the soil-ice wall brings about various kinds of cryogenic textures. The cryogenic textures, in their turn, affect the strength of the artificially frozen soil-ice wall. It was shown that upon loading, the variously oriented hexagonally crystallized ice crystals, upon application of externally applied loads may become subjected to compression or bending or shear stresses, and/or to a combination of such stresses. Also, sustained loads on a frozen soil may bring about time-dependent, long-term deformation of the ice, viz., frozen soil, known as the rheological phenomenon creep. It was postulated that the strength and performance of the composite frozen soil--the ice wall--is a function of its components, such as the soil cryogenic texture, its thermal regimen, and the strength of the ice. It was also pointed out that the performance of the ice wall should be evaluated in terms of its strength and strains. (See also W80-01498) (Sims-ISWS)
W80-01507

PREDICTION OF SALT INFLUENCE ON UNFROZEN WATER CONTENT IN FROZEN SOILS,
McGill Univ., Montreal (Quebec). Geotechnical Research Centre.
R. N. Yong, C. H. Cheung, and D. E. Sheeran.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 137-155, April 1979. 11 Fig, 2 Tab, 9 Ref.

Descriptors: *Frozen soils, *Salts, *Pore water, *Model studies, Mathematical models, Theoretical analysis, On-site investigations, Data processing, Soils, Soil water, Soil moisture, Soil types, Montomorillonite, Kaolinite, Solutes, Saline soils, Temperature, Frozen ground, Ice, Grundite.

The influence of salts in the pore water in freezing soils was examined from the experimental viewpoint, using the differential scanning calorimetry technique for generation of multiple endotherms of the frozen test samples. The experimental values obtained for montmorillonite, kaolinite, and grundite were evaluated in terms of unfrozen water contents for the respective soils at various subfreezing temperatures for various concentrations of NaCl. Comparison of experimental values with theoretical predictions using a combined salt exclusion and diffuse double-layer model showed excellent quantitative agreement for the montmorillonite soil samples, but only qualitative agreement appeared for the kaolinite and grundite soil. The reasons for this lie in the theoretical model requirement for interlamellar migration of water in soil freezing for suitable application of the diffuse double-layer part of the model. (See also W80-01498) (Sims-ISWS)
W80-01508

UNFROZEN WATER AS A FUNCTION OF CLAY MICROSTRUCTURE,
Lulea Univ. (Sweden). Div. of Soil Mechanics.
R. Pusch.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 157-162, April 1979. 6 Fig, 4 Ref.

Descriptors: *Frozen soils, *Soil water, *Freezing, Laboratory tests, Soils, Soil types, Clays, Aggregates, Frozen ground, Analytical techniques, Soil science.

A previous study of microstructural changes in freezing clay suggested that a 'dispersed' freshwater clay should have a higher percentage of unfrozen water than a (leached) marine clay with similar mineralogical and granulometrical compositions. This report described an investigation where two such clays were actually compared concerning their contents of unfrozen water. The results confirmed the hypothesis. Thus, the influence of clay microstructure on the amount of unfrozen water was clearly shown. The degree of particle aggregation and the density of the particle aggregates are the main microstructural parameters. (See also W80-01498) (Sims-ISWS)
W80-01509

INTERRELATIONSHIP OF THE PRINCIPAL PHYSIOCOMECHANICAL AND THERMOPHYSICAL PROPERTIES OF COARSE-GRAINED FROZEN SOILS,
Kuybyshevskii Inzhenero-Stroitelnyi Inst. (USSR). Frozen Soil Science and Power Plant Construction Branch Research Lab.
N. A. Tsytovich, and Ya. A. Kronik.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 163-167, April 1979. 9 Ref.

Descriptors: *Frozen soils, *Soil properties, *Soil types, *Construction, Cryogenics, Freezing, Frozen ground, Physical properties, Mechanical properties, Thermal properties, Aggregates, Particle size, Soils, Soil science.

The results of physical, mechanical, and thermomechanical investigations of frozen coarse-grained soils with sandy clay aggregate were discussed. A general classification of coarse-grained soils with fine aggregate, subdividing into skeleton and non-skeleton soils, and new methods for determination of their physicomechanical and thermal characteristics were proposed. Special methods and formulas were given that allow calculation of the main physiocomechanical and thermal characteristics of coarse-grained soils in the same way as those of coarse particles and fine aggregates. In common complex stability and deformation problems and in research on frozen, freezing, and thawing soils, taking into account cryogenic and thermo mass transfer processes, it was proposed to investigate these soils on the basis of thermoelasticity and thermomechanics (rational thermodynamics). (See also W80-01498) (Sims-ISWS)
W80-01510

ICE LENS STRUCTURES, COMPRESSION STRENGTHS AND CREEP BEHAVIOR OF SOME SYNTHETIC FROZEN SILTY SOILS,
Continental Oil Co., Ponca City, OK.
F. J. Radd, and L. H. Wolfe.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 169-183, April 1979. 8 Fig, 5 Tab, 3 Ref.

Descriptors: *Ice, *Frozen soils, *Frozen ground, Laboratory tests, Soil strength, Compressive strength, Soil properties, Creep, Mechanical properties, Construction, Structures, Soils, Soil types, Freezing, Sampling, Cryogenics, Soil science, Ice lenses.

This research paper concerned the frozen state properties of several silty soils encountered in the construction of a large LNG storage cavern near Carlstadt, New Jersey. The creep and compression strengths were correlated with both field and laboratory measured mechanical properties. These cryogenic mechanical properties were related to ice lens structures, sizes, and occurrences, and to

heat flow and geological structure effects. Three distinct and separate types of ice lenses were identified. These cryogenic ground data pertain to the prediction of the engineering properties of frozen earth for large structures. Sample size effect problems were investigated, this in relationship to the number and size and orientations of the ice lenses present. (See also W80-01498) (Sims-ISWS)
W80-01511

CREEP BEHAVIOUR OF FROZEN SOILS IN UNIAXIAL COMPRESSION TESTS,
Karlsruhe Univ. (Germany, F.R.). Inst. of Soil Mechanics and Rock Mechanics.
For primary bibliographic entry see Field 8D.
W80-01512

CREEP CHARACTERISTICS OF FROZEN SOILS,
Shimizu Construction Co., Ltd., Tokyo (Japan).
For primary bibliographic entry see Field 8D.
W80-01513

EFFECT OF SPECIMEN SHAPE ON CREEP RESPONSE OF A FROZEN SAND,
Ecole Polytechnique de Montreal (Quebec). Centre d'Ingenierie Nordique.
For primary bibliographic entry see Field 8D.
W80-01514

STRAIN RATE EFFECT ON THE COMPRESSIVE STRENGTH OF FROZEN SAND,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
For primary bibliographic entry see Field 8D.
W80-01515

CYCLIC TRIAXIAL TESTS ON FROZEN SAND,
Michigan State Univ., East Lansing.
J. C. Li, G. Y. Baladi, and O. B. Andersland.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 233-246, April 1979. 13 Fig, 11 Ref.

Descriptors: *Frozen soils, *Sands, *Laboratory tests, Youngs modulus, Silica, Strain, Measurement, Soil physical properties, Analysis, Methodology, Analytical techniques, Cycles, Frequency, Instrumentation, Loads(Forces), Temperature, *Triaxial tests, Ottawa sand, Confining pressure, Axial strain.

Strain-controlled cyclic triaxial tests were performed on a one-size silica (Ottawa) sand artificially frozen into 71.1-mm-diameter cylindrical samples. Ice-saturated samples with three different sand contents were tested under the following conditions: axial strains ranging from 0.003 to 0.03%, confining pressures from zero to 1.378 MPa, frequencies of 0.05-5.0 cps, and temperatures from -1 to -10C. Test equipment included an MTS electrohydraulic closed-loop testing system which applies the load to the sample, a triaxial cell completely immersed in a low-temperature coolant for temperature control, a refrigeration unit for control of the coolant temperature and constant coolant circulation, and measuring devices including an LVDT and load cell, together with recording devices such as a digital multimeter, an oscilloscope, a strip-chart recorder, and a minicomputer. Test results indicated that the dynamic Young's modulus increases with increasing frequency, confining pressure and sand content, but decreases with increasing strain and temperature. The damping ratio decreases with increasing frequency, sand content and lower temperatures. The influence of confining pressures and axial strain on the damping ratio are less explicit for the ranges considered. The experimental results were compared with data from other sources. Available data cover only low (0.1-10 cps) and high (1000 to 10,000 cps) frequencies. The longitudinal wave velocity increases gradually with increasing frequency and appears to be relatively independent of soil type. The damping ratio decreases with increasing loading frequency. Damping ratios for the Ottawa sand are intermediate to the frozen silt and clay soils. (See also W80-01498) (Humphreys-ISWS)
W80-01516

EFFECT OF FREEZE-THAW CYCLES ON RESILIENT PROPERTIES OF FINE-GRAINED SOILS,
Army Terrestrial Sciences Center, Hanover, NH.
T. C. Johnson, D. M. Cole, and E. J. Chamberlain.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 247-276, April 1979. 25 Fig, 1 Tab, 20 Ref.

Descriptors: *Freeze-thaw tests, *Frozen soils, *Soils, *Soil physical properties, On-site tests, Laboratory tests, Methodology, Testing procedures, Mechanical properties, Clays, Silts, Deformation, Soil temperature, Analysis, Analytical techniques, Poisson ratio, Triaxial tests, Resilient modulus, Hanover silt, Morin clay.

Stress-deformation data for silt and clay subgrade soils were obtained from in-situ tests and laboratory tests for use in mechanistic models for design of pavements that will experience freezing and thawing. Plate-bearing tests were run on in-service, all-bituminous-concrete (ABC) pavements constructed directly on silt subgrade and on an experimental ABC pavement constructed on clay subgrade, applying repeated loads to the pavement surfaces while the subgrade was frozen, thawing, thawed, and fully recovered. The in-service pavement had experienced several seasons of natural cyclic freezing and thawing, while the experimental pavement was artificially frozen and thawed twice. Repeated-load laboratory triaxial compression tests were performed on the same soils in the frozen and thawed states. Analysis of deflection data from the in-situ tests showed resilient moduli of the subgrade soils up to more than 10 GPa when frozen, as low as 2 MPa during the thawing period, and up to more than 100 MPa when fully recovered. Analysis of the laboratory tests, which gave moduli comparable to the latter values, showed that resilient modulus and Poisson's ratio in the thawed and recovering conditions can be expressed as a function of the stress state, the moisture content, and the dry density. (See also W80-01498) (Humphreys-ISWS)
W80-01517

PRESSURE OF THAWING SOILS ON THE CONCRETE LINING OF VERTICAL MINE SHAFTS,
Research Inst. of Bases and Underground Structures, Gosstroi (USSR).
F. Ya. Novikov.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 277-286, April 1979. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Frozen soils, *Frozen ground, *Thawing, *Shafts, Mines, Mining, Structures, Model studies, Mathematical models, laboratory tests, Soil moisture, Ice, Concrete, Mining engineering, Mine shafts.

This paper presented data on the theoretical and experimental investigations for revealing characteristic features of the development of pressure of thawing clayey soils on the concrete lining of mine shafts. The concrete shaft lining and frozen soil massif were considered as rigid walls resting on a rigid base (bedrock). While the thawing soil is being consolidated due to gravity, because of friction and cohesion it transmits loads on to the walls. The report showed that the development of the loads on the mine shaft lining due to soil thawing is divided into two stages. This paper presented the technique of experiments effected on the mine shaft models. It was noted that, owing to nonuniform thawing of soils close to the mine shaft, the soil displacement begins on the side with the greater thawing. This may cause nonuniform lateral pressure on the concrete mine shaft lining, endangering its stability. (See also W80-01498) (Sims-ISWS)
W80-01518

SOME ASPECTS OF ARTIFICIAL THAWING OF FROZEN SOILS,
Rutgers-The State Univ., New Brunswick, NJ.
A. R. Jumikis.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 287-297, April 1979. 3 Fig, 14 Ref.

Descriptors: *Frozen soils, *Frozen ground, *Permafrost, *Thawing, Model studies, Mathematical models, Heat flow, Temperature, Construction, Cold weather construction, Civil engineering, Soil defrosting, Artificial thawing.

Despite its important practical value, the problem of artificial thawing of frozen soils by the vertical, cylindrical defreezer-pipe method has been studied only comparatively recently. To facilitate excavation and/or foundation work in frozen soil in seasonally freezing and/or permafrost regions, the frozen soil can be loosened up, among other methods, by artificial thawing. For this purpose, it is necessary to evaluate the amount of thermal energy needed to bring about the desired thawing. Such an evaluation involves consideration of the relationships between the frozen and thawed soil properties; temperature of the defrosting agent; the size and spacing of the defreezer pipes; and the time required to thaw a certain amount of frozen soil. Although in practice several methods are used for artificial thawing, in this paper discussion on and calculations for defrosting of frozen soil were presented relative only to thawing by means of vertically installed defreezer pipes. (See also W80-01498) (Sims-ISWS)
W80-01519

ICE BEAHAVIOUR UNDER LOAD,
All-Union Designing, Surveying and Scientific Research Inst. Hydroproject, Moscow (USSR).
Yu. K. Zaretsky, B. D. Chumichev, and V. I. Solomatin.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 299-309, April 1979. 7 Fig, 10 Ref.

Descriptors: *Ice, *Loads(Forces), *Compressive strength, *Frozen ground, Frozen soils, Strain, Stress, Creep, Failure(Mechanics), Rheology, Laboratory tests, Model studies, Mathematical models, Mechanical properties, Deformation, Elastic deformation, Temperature.

Ice is a component of frozen grounds that determines their rheological properties. Deformation and failure of ice under load were regarded by the authors as a single process due to the kinetics of defect development in the crystalline structure of ice. Results of experimental investigations into the regularities of ice strain and failure under the conditions of short-time creep were given in this paper. The experiments were to test ice for creep under a uniaxial compressive stress, using the emission-acoustic method of recording the microcrack formation. It was shown experimentally that the ultimate strength of ice signifying a maximum stress after which ice deforms plastically, without passing into the stage of accelerated flow, is consistent with the stress under which the process of microcrack formation begins. It was found that this limit is independent of temperature. As a result of the study, an analytical relationship was determined between defect number, stress, and time, and an equation of ice strain was deduced on the basis of statistical methods. This equation estimates temporal creep strain development, depending on stress, structural characteristics of ice, and its temperature. (See also W80-01498) (Sims-ISWS)
W80-01520

THERMAL AND RHEOLOGICAL COMPUTATIONS FOR ARTIFICALLY FROZEN GROUND CONSTRUCTION,
Army Terrestrial Sciences Center, Hanover, NH.

F. J. Sanger, and F. H. Sayles.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 311-337, April 1979. 16 Fig, 1 Tab, 32 Ref.

Descriptors: *Frozen ground, *Construction, *Freezing, *Model studies, Mathematical models, Frozen soils, Cofferdams, Retaining walls, Hydraulic structures, Ice, Creep, Strength, Soil strength, Rheology, Civil engineering, Artifical freezing, Frozen ground construction.

Design consideration for frozen retaining structures were summarized and included geology and groundwater conditions; ground deformations due to freezing; the strength and deformation of the frozen earth retaining structures; the thermal assumption and methods of computation; and the refrigeration system. Brief case histories of typical construction projects that illustrate the use of mechanical refrigeration and liquid nitrogen for freezing were presented. Emphasis was placed on the constitutive equation for creep deformation of frozen earth structures and the thermal calculations for predicting times to freeze a structure as well as estimating the energy and power required for different stages of freezing. (See also W80-01498) (Sims-ISWS)
W80-01521

STABILITY OF MINE WORKINGS IN FROZEN SOILS,
Research Inst. of Bases and Underground Structures, Gosstroi (USSR).
S. S. Vyalov, Yu. K. Zaretsky, and S. E. Gorodetsky.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 339-351, April 1979. 6 Fig, 1 Tab, 3 Ref.

Descriptors: *Frozen soils, *Frozen ground, *Mining, *Freezing, Model studies, Mathematical models, Construction, Retaining walls, Ice, Strength, Creep, Stability, Equations, Mining engineering, Artificial freezing.

The laws of rheological processes (creep and long-term strength) occurring in frozen soils were considered, and initial equations were formulated. Methods for determining the strength and deformability characteristics were described; the values of these characteristics were given. Methods were considered for calculating the optimum thickness of the walls of ice-soil retaining structures built by means of artificial freezing as well as methods of design for creep and long-term strength of the frozen soil surrounding various mine workings. The corresponding calculation equations were given; graphs were attached to facilitate the use of these equations. The calculation techniques were illustrated with examples. (See also W80-01498) (Sims-ISWS)
W80-01522

CREEP STRESS ANALYSIS OF FROZEN SOILS UNDER MULTIAXIAL STATES OF STRESS,
Bochum Univ. (Germany, F.R.). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8D.
W80-01523

DESIGN OF TUNNEL SUPPORT SYSTEMS USING GROUND FREEZING,
Law Engineering Testing Co., McLean, VA.
For primary bibliographic entry see Field 2G.
W80-01525

GROUND FREEZING MONITORING TECHNIQUES,
International Versuchsanstalt for fuer Fels G.m.b.H., Bentheim (Germany, F.R.). Interfels.
For primary bibliographic entry see Field 2G.
W80-01530

GROUND CONSOLIDATION WITH LIQUID NITROGEN (LN2),
Linde A.G., Hollriegelskreuth (Germany, F.R.). Technical Gases Div.
G. Veranneman, and D. Rebhan.
In: Ground Feeezing: Proceedings of the First International Sympsoium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 473-484, April 1979. 6 Fig.

Descriptors: *Frozen ground, *Frozen soils, *Freezing, *Consolidation, Equipment, Methodology, Nitrogen, Cooling, Temperature, Construction, Model studies, Laboratory tests, On-site investigations, Civil engineering, Liquid nitrogen, Artificial freezing.

A brief introduction to the method was given, and the technical details of practical interest, such as the nitrogen supply system, materials, equipment, and safety precautions, were discussed. Laboratory tests were carried out to ascertain basic data. The test setup, test procedure, and results were set forth. Information essential to the planning of nitrogen freeze operations was obtained. The practical application of the method was illustrated by reference to several examples. Nitrogen freezing is gaining steadily in importance, thanks to a series of technical benefits allied to the need for cleaner and safer building methods. The specific nitrogen consumption was indicated, and the question of efficiency was discussed. (See also W80-01498) (Sims-ISWS)
W80-01531

USES AND LIMITATIONS OF GROUND FREEZING WITH LIQUID NITROGEN,
Deilmann-Haniel G.m.b.H., Dortmund (Germany, F.R.).
K. Stoss, and J. Valk.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 485-494, April 1979. 4 Fig, 2 Tab.

Descriptors: *Frozen ground, *Frozen soils, *Freezing, *Consolidation, Nitrogen, Cooling, Temperature, Construction, Retaining walls, Tunnels, Costs, Cost comparison, Methodology, Civil engineering, Liquid nitrogen, Artificial freezing.

The question whether ground freezing by direct gasification of liquid nitrogen (LN2) is an alternative to conventional freezing by circulation of liquid coolants was discussed. Also discussed were: the technical characteristics of and basic differences between the two methods; the specific advantages and disadvantages of ground freezing with LN2; the relevant cost factors and their influence on the overall cost of a freezing project; and the criteria for the technical and economic feasibility of LN2 freezing in construction work. A description was given of four typical applications: for temporary foundations; sealing of a defective diaphram wall; final sealing of a designed gap in a bored pile retaining wall; and driving of a water tunnel under a railway embankment. (See also W80-01498)(Sims-ISWS)
W80-01532

NATURAL FROST IN IMPROVEMENT OF CONSTRUCTION PROPERTIES OF GROUND IN HYDROENGINEERING AND INDUSTRIAL AND CIVILIAN CONSTRUCTION,
Akademiya Nauk SSSR, Yakutsk. Inst. Merzuotovedeniya.
P. I. Mel'nikov, V. I. Makarov, G. F. Biyanov, and L. I. Kudoyarov.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (German), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 495-503, April 1979. 5 Fig.

Descriptors: *Frozen ground, *Permafrost, *Cold regions, *Construction, Freezing, Heat transfer, Cooling, Cold weather construction, Frozen soils, Strength, Foundations, Structures, Civil engineering, Artificial freezing, Artificial ground freezing, Thermosiphons.

Artificial freezing of ground by refrigerating machines requires considerable power and expense, so it is comparatively seldom applied and almost always for a short period. In the regions of severe climate, seasonal freezing and long-term preservation of low temperatures in a mass of frozen ground can compete in effectiveness and economy with the traditional methods of loose ground stabilization, quicksand and boggy-clayey deposits, in particular. In practice, different methods and systems are applied for freezing the ground using the cold atmosphere air as a heat-adsorbing medium. Systems with forced pumping of the intermediate heat carrier or of the air itself are more economical than machine freezing, but they are unreliable and maintenance is very expensive. Freezing devices using natural circulation of a single-phase and double-phase heat carrier in hermetically sealed cavities or thermosiphons permit effective temperature variation of the ground and atmosphere air with the minimum operating expense. The paper considered the operational features of freezing systems and different devices, and gave examples of the utilization of artificially frozen ground in hydraulic structures and in foundations of industrial buildings and dwelling houses. The possiblity of creating artificially frozen masses used as foundations of the structures built in severe climatic regions was considered, and examples of the existing buildings constructed on the artificial lenses of frozen ground were given. (See also W80-01498) (Sims-ISWS)
W80-01533

FROST PROTECTION OF RAILWAY LINES,
Norwegian State Railways, Oslo (Norway).
H. Hartmark
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 505-517, April 1979. 10 Fig, 3 Tab, 26 Ref.

Descriptors: *Frost protection, *Railroads, *Frost, Frozen ground, Drainage, Frost heaving, Insulation, Peat, Bark, Methodology, Plastics, Foreign countries, *Norway, *Sweden, *Finland, Foam plastic.

The modern operation of railways with speeds of more than 100 km/h with all-welded rails and concrete sleepers demands a railway line completely free of frost heave. On railway lines in service (in operation), protection against frost is achieved by materials demanding only a minimum insulation depth, i.e., peat, bark, discarded sleepers, or foam plastic. The combination of foam plastic with a gravel layer beneath is the most sidely used method today (1978). Since 1945, the Norwegian State Railways have carried out frost protection works. In Sweden and Finalnd, systematic frost protection work has been carried out, mainly on the same principles as in Norway. This paper described the methods being used in railway construction with dimensional diagrams for frost insulation. (See also W80-01498) (Humphreys-ISWS).
W80-01534

APPLICATION OF THE GROUND-FREEZING METHOD TO PENETRATE A SEQUENCE OF WATER-BEARING AND DRY FORMATIONS--THREE CONSTRUCTION CASES,
Thyssen Schachtbau G.m.b.H., Mulheim an der Ruhr (Germany, F.R.).
For primary bibliographic entry see Field 2G.
W80-01537

2E. Streamflow and Runoff

EFFECTS OF SUBURBAN CONSTRUCTION ON RUNOFF CONTRIBUTING ZONES IN A SMALL SOUTHERN ONTARIO DRAINAGE BASIN,
Trent Univ., Peterborough (Ontario). Dept. of Geography.
C. H. Taylor, and D. M. Roth
Hydrological Sciences Bulletin, Vol 24, No 3, p 289-301, September 1979. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Runoff, *Construction, *Urbanization, *Effects, *Canada, Rainfall, Snowmelt, Seasonal, Precipitation(Atmospheric), Storm runoff, Peak discharge, Urban runoff, Hydrographs, Land use, Soil moisture, Infiltration, Hydrology, Suburban construction effects.

The runoff response of a small drainage basin in southern Ontario has been monitored over a 5 year period, during which 25% of its surface has been modified by suburban construction activity. Direct runoff response to summer and autumn rainstorms has not been noticeably affected by the development, but response to spring snowmelt has increased by three to four times. Summer and autumn storm runoff still appears to be generated mainly by direct precipitation on a natural, saturated, contributing zone alongside the channel which has been little affected by the construction activity. The construction surfaces have had their infiltration capacities greatly reduced by devegetation and compaction, but runoff from them does not contribute to the storm hydrograph unless ephemeral channels and swales which link them to the main stream are saturated and capable of conducting flow. This happens rarely during rainstorms, but consistently during snowmelt, when ground conditions are extremely wet. The seasonal contrasts in the effect of partial suburban development on direct runoff response are caused, therefore, by seasonal variations in the extent to which the construction surfaces are integrated into the active runoff contributing zone of the drainage basin. (Sims-ISWS).
W80-01272

FLOW AND FLOW ROUTING IN UPLAND CHANNEL NETWORKS,
Institute of Hydrology, Wallingford (England).
K. Beven, K. Gilman, and M. Newson.
Hydrological Sciences Bulletin, Vol 24, No 3, p 303-325, September 1979. 15 Fig, 4 Tab, 42 Ref.

Descriptors: *Flow, *Channel flow, *Streamflow , Channels, Networks, Open channel flow, Routing, On-site investigations, Watersheds(Basins), Discharge(Water), Velocity, Tracers, Measurement, Model studies, Mathematical models, Hydrographs, Hydrology, Channel networks, Flow routing.

This paper was based on the premise that the distribution of discharge source areas in relation to the channel network may have a significant effect on the form of the basin hydrograph, and that, in consequence, it is of value to investigate routing models for application to the channel networks of upland catchments. The channels of such networks are generally small, steep, and rough, with complex flow through a sequence of pools and riffles or rapids. The gulp dilution gauging method provided a useful technique for investigating the bulk properties of flow over complete channel reaches. At least for low to medium flows, it was shown that average flow velocities increase nonlinearly both downstream and with increasing discharge in a manner that is not compatible with traditional analysis in terms of uniform flow equations. The dilution gauging measurements may be used to provide parameters for a nonlinear kinematic routing model. The model was applied to channel networks of two small British basins (about 8 sq km), and the response to different hydrograph magnitudes was explored. The model provided a suitable compromise between the requirements of simplicity and the inclusion of the nonlinearity in channel response, but, at the scale of application, the model parameter values derived from the field measurements may overestimate velocities at high discharges. (Sim-ISWS)
W80-01273

RESUME OF RESEARCH INTO RIVER CHANNEL CHANGES CONDUCTED IN THE USSR,
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
For primary bibliographic entry see Field 2J.
W80-01274

FLOOD SIMULATION MODEL,
Public Works Research Inst., Tsukuba (Japan).
A. Tsuchiya, K. Ishizaki, and K. Sasaki.
Hydrological Sciences Bulletin, Vol 24, No 3, p 361-373, September 1979. 11 Fig, 1 Tab, 2 Ref.

Descriptors: *Floods, *Simulation analysis, *Model studies, Mathematical models, Flood forecasting, Flood recurrence interval, Flood plains, Rivers, Unsteady flow, Streamflow, Rainfall, Precipitation(Atmospheric), Hydrographs, Drainage, Watersheds(Basins), Hydrology, *Japan, *Tomoe River(Japan).

In Japan, low flat flood-prone areas are increasingly being developed. This paper described a flood simulation model based on unsteady flow for calculating floods in such regions. The model was applied to the Tomoe River basin. (Sims-ISWS)
W80-01275

PROBABILITY ANALYSIS OF HISTORICAL FLOOD DATA,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
R. Gerard, and E. W. Karpuk.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14834, p 1153-1165, September 1979. 6 Fig, 1 Tab, 5 Ref.

Descriptors: *Flood frequency, *History, *Flood data, Backwater, Bridges, Flood control, Ice jams, Probability, Rivers, Frequency analysis, Hydrology, *Flood historical data, Ice breakup.

In addition to routinely collected hydrometric data, information on past river water levels at a site can often be gathered from various other sources such as residents and archives. However, these sources generally have varying reliability, overlapping and broken periods of record, and no well-defined reference levels--features that have made the probability analysis of this data difficult. The paper described a simple method of incorporating such data into probability analyses and illustrated it by application to the probability analysis of ice breakup stages on the Peace River at Fort Vermilion, Alberta, Canada. There is generally little standard hydrometric information on such water levels, and yet they are often a very significant component of the annual maximum water levels in cold regions. In such situations, the analysis of historical data is particularly important. (Lee-ISWS)
W80-01279

OPEN CHANNEL FLOW WITH VARYING BED ROUGHNESS,
Birmingham Univ. (England).
D. W. Knight, and J. A. Macdonald.
Journal of the Hydraulics Division,American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14839, p 1167-1183, September 1979. 11 Fig, 1 Tab, 24 Ref, 2 Append.

Descriptors: *Boundary layers, *Flumes, *Open channel flow, Roughness coefficient, Roughness (Hydraulic), Flow, Equations, Velocity, Turbulence, Walls, *Boundary shear, Velocity distribution, Bed roughness, Open channel hydraulics.

The distribution of velocity and boundary shear stress in a rectangular flume has been examined experimentally, and the influence of varying the bed roughness and aspect ratio was assessed. The resistance of the channel bed was varied by means of artificial strip roughness elements, and measurements were made of the wall and bed shear stresses. Dimensionless plots of both shear stress and shear force parameters were presented for different bed roughnesses and aspect ratios, and these serve to illustrate the complex way in which such parameters vary. The definition of a 'wide' channel was also examined, and a graph giving the limiting aspect ratio for different roughness conditions was presented. The boundary shear stress distributions and isovel patterns were used to examine one of the standard side-wall correction procedures. One of the basic assumptions underlying the procedure was found to be untenable due to the cross channel transfer of linear momentum. (Lee-ISWS)
W80-01280

FLOOD PLAIN INFORMATION: CUCHARAS RIVER AND TRIBUTARIES, LA VETA, COLORADO,
Army Engineer District, Albuquerque, NM.
Prepared for the Huerfano County Board of County Commissioners, NM, May 1977. 26 p 5 Fig, 22 Plates, 5 Tab.

Descriptors: *Colorado, *Flood data, *Flood frequency, *Peak discharge, *La Veta(CO), *Cucharas River(CO), *Floods, Indirect flood measurement, Flood profiles, Historic floods, Flood frequency interval, Flood stages, Flood peak, Flow duration, Flow charactristics, Stage-discharge relations, Flood protection, Warning systems, Huerfano County(CO), Boyd Ranch(CO), Middle Creek(CO), 100-year flood, 500-year flood.

The study area encompasses the flood plain of the Cucharas River near the community of La Veta and vicinity. The flood plain contains agricultural developments, cattle raising, some mining and a small amount of residential development. Flood data were collected from a stream gaging station near Boyd Ranch, NM, field surveys, and interviews with local citizens. There are no flood control structures on the stream that would affect flooding in La Veta and vicinity. The greatest precipitation in the study area mormally occurs in the late spring and summer months. Storms characteristic of the area are usually of the thunderstorm or cloudburst type. Definitive data on velocities, magnitude, and duration of past floods in La Veta are not available. Interviews with local citizens disclosed that flooding did occur in 1923 and 1946. The 100-year flood occurring about the mouth of Middle Creek is predicted to have a discharge of 6,100 cubic feet per second (cfs) and reach a height of 3.3 feet above bankfull stage. The 500-year flood is predictd to have a peak discharge of 11,600 cfs and reach a height of 4.2 feet above bankfull stage. This report provides a suitable basis for land use planning to guide flood plain development and prevent future losses. (Coan-NC)
W80-01400

FLOOD PLAIN INFORMATION: CUCHARAS RIVER AND TRIBUTARIES, WALSENBURG, COLORADO,
Army Engineer District, Albuquerque, NM.
Prepared for the Huerfano County Board of County Commissioners, CO, July 1977. 24 p 3 Fig, 18 Plates, 5 Tab.

Descriptors: *Colorado, *Flood data, *Peak discharge, *Walsenburg(CO), *Cucharas River(CO), *Floods, Indirect flood measurement, Flood profiles, Historic floods, Flood frequency, Flood stages, Flood peak, Flow duration, Flow characteristics, Flood protection, Non-structural alternatives, Flood plain insurance, Warning systems, Control structures, Dams, Huerfano County(CO), 100-year flood, 500-year flood.

The study area covers the flood plains of Cucharas River, Bear Creek, and the North Walsenburg Ditch near Walsenburg, Colordo and vicinity. Existing developments on the flood plains in the study area are primarily residential but include commercial and industrial developments. Large amounts of the flood plains are rural land. Flood data were obtained from topographic maps, field visits, and intensive interviews with local citizens. The North Walsenburg Flood Control Project provides flood control to North Walsenburg and flood plain management standards have been adopted. Storms characteristic of the watershed are usually of the thunderstorm of cloudburst type occurring in the early spring. No data presentd concerning historical floods although interviews with local citizens report that flooding did occur on August 6, 1936. On the Cucharas River at station 0+00 the 100-year flood would discharge 23,700 cubic feet per second (cfs) and the 500-year flood would discharge 48,200 cfs with a rise of 7 and 9 feet, respectiely, above bankfull stage. On Bear Creek at station 24+10, the 100-year flood would discharge 11,300 cfs and the 500-year flood, 23, 100 cfs. This report will aid in the development

of flood damage reduction methods and provide a suitable basis for land use planning. (Coan-NC)
W80-01401

FLOOD PLAIN INFORMATION: GILMORE CREEK, BURNS VALLEY CREEK, PLEASANT VALLEY CREEK, VICINITY OF WINONA, MINNESOTA,
Army Engineer District, St. Paul, MN.
Prepared for the City of Winona, MN, May 1975. 36 p, 14 Fig, 19 Plates, 5 Tab.

Descriptors: *Minnesota, *Flood profiles, *Flood data, *Peak discharge, *Flood plains, *Gilmore Creek(MN), *Burns Valley Creek(MN), *Winona(MN), *Pleasant Valley Creek(MN), Floods, Indirect flood measurement, Historic floods, Flood recurrence interval, Flood stages, Flood peak, Flow duration, Flow characteristics, Rivers, Flood protection, Flood plain zoning, Control structures, Flow control, Levee, Reservoirs, Standarad Project Flood, Control structures, Flow control, Levee, Reservoirs, Standard Project Flood, Intermediate Regional Flood.

The study area includes the flood plains of Gilmore, Burns Valley, and Pleasant Valley Creeks in the vicinity of Winona, Minnesota. Development in the flood plains are primarily agricultural but scattered residential developments exist along the entire lengths of the valleys. Flood data were gathered from U.S. Geological Survey stream gages, historical documents, and topographic maps. Flood control structures in the area consist of reservoirs, levees, and sediment settling basins; there is some flood plain zoning. The largest floods in the area are usually caused by intense rainfall of short duration which occur during spring and summer. The worst recorded flood in the area occurred on July 21, 1951, on Gilmore Creek, with a peak discharge of 5,360 cubic feet per second (cfs) and reaching an elevation of 681.9 feet mean sea level (msl). The Intermediate Regional Flood peak discharges for Gilmore, Burns Valley, and Pleasant Valley Creeks would be 7,140 cfs, 9,200 cfs, and 9,050, respectively. For the Standard Project Flood, the peak discharge for Gilmore Creek would be 12,900 cfs, for Burns Valley Creek, 18,500 cfs, and for Pleasant Valley Creek, 17,800 cfs. This report provides a suitable basis for the adoption of land use control to guide flood plain development and for adopting other flood damage reduction techniques. (Coan-NC)
W80-01403

FLOOD HAZARD INFORMATION: ANIMAS RIVER AND HERMOSA CREEK, HERMOSA, COLORADO,
Army Engineer District, Sacramento, CA.
Prepared for La Plata County and the Animas Regional Planning Commission, CO, October 1977. 14 p, 5 Fig, 32 Plates, 5 Tab.

Descriptors: *Colorado, *Floods, *Flood profiles, *Storms, *Cloudbursts, *Flood peak, *Flow characteristics, *Flood plain insurance, *Hermosa Creek(CO), *Animas River(CO), *Hermosa(CO), *La Plata County(CO), Flood flow, Indirect flood measurement, Flood forecasting, Historic floods, Flood data, Flood stages, Flood damage, Erosion, Rivers, Floodways, Flood plains, Flood protection, Non-structural alternatives, 100-year flood, 500-year flood.

The study area covers the Animas River and Hermosa Creek in the vicinity of Hermosa, La Plata County, CO. A 13.6 mile stretch of the Animas River and 2.8 mile reach of the Hermosa Creek were investigated. The Animas River is a tributary of the Colorado River and combined with Hermosa Creek drains an area of 1,374 square miles. Development in the floodplain is mainly agricultural, with some rural residences and limited commercial development. Flooding is caused by large rainstorms, rapidly melting snow and localized cloudburst storms; the flood season is from mid-June-December. Obstructions to flood waters consist mainly of natural vegetation plus a few bridges. Recent floods have occurred in 1949, 1952, 1957, 1970 and 1973. The greatest flood on the Animas River occurred in 1911 with a peak flow of 25,000 cubic feet per second (cfs), while the greatest flood on Hermosa Creek was in 1941 with a peak flow of 2,980 cfs. For the 100-year flood the peak flow for the Animas River and Hermosa Creek would be 25,000 cfs and 4,400 cfs, respectively; for the 500-year flood the peak flow would be 42,000 cfs and 6,300 cfs, respectively. There are no existing or authorized flood control reservoirs in the study area. La Plata County is eligible for federal flood insurance. This report will aid in planning the best use of lands subject to flooding from the 100- and 500-year floods. (Iervolino-NC)
W80-01412

FLOOD HAZARD INFORMATION: COLORADO RIVER AND TRIBUTARIES: FRUITA, CO,
Army Engineer District, Sacramento, CA.
Prepared for the Town of Fruita and Mesa County, CO, November 1976. 9 p, 55 Plates, 5 Tab.

Descriptors: *Colorado, *Floods, *Flood profiles, *Peak discharge, *Floodways, *Colorado River(CO), *Fruita(CO), *Mesa County(CO), Indirect flood measurement, Flood damage, Erosion, Rivers, Flood protection, Non-structural alternatives, Flood plain zoning, Land use, Zoning, Reed Wash(CO), Big Salt Wash(CO), Little Salt Wash(CO), 100-year flood, 500-year flood.

The study area includes the Colorado River in Colorado and three of its direct tributaries: Reed, Big Salt and Little Salt Washes, all in the vicinity of Fruita, CO. The drainage area totals 17,100 square miles for the Colorado River and 177 square miles for the three tributaries combined. Data were collected for 12 miles along the Colorado River from 22 Road downstream to about 13 Road and for a total of 5.7 miles for all three Washes. Development in the flood plain is mainly agricultural. The cause of flooding is snowmelt in the spring and it is most severe when augmented by rain. Obstructions to floodflow are mainly natural materials such as trees, brush and other vegetation. The earliest and most severe flood occurred during June-July 1884. Other floods occurred in 1917, 1920, 1921, 1935, 1952, and 1957. For the 100-year flood the peak flow was 82,000 cubic feet per second (cfs), 3,500 cfs, 7,900 cfs, and 4,300 cfs for the Colorado River, Reed Wash, Big Salt Wash and Little Salt Wash, respectively. The peak flow for the 500-year flood would be 107,000 cfs, 7,600 cfs, 16,700 cfs, 8,100 cfs, respectively, for the same streams. Average velocities for the 100-year flood would be 7-9 feet per second (fps) for the main channel of the Colorado River, 8-10 fps for the Reed Wash channel, 6-8 fps for the Big Salt Wash channel and 8-12 fps for the Little Salt Wash channel. Formal operating regulations for flood control have not been prepared for the study area. Flood plain regulations have been adopted by Mesa County. (Iervolino-NC)
W80-01413

FLOOD HAZARD INFORMATION: YAMPA RIVER AND TRIBUTARIES, CRAIG, COLORADO,
Army Engineer District, Sacramento, CA.
Prepared for the City of Craig and Moffat County, CO, November 1977. 25 p, 11 Fig, 44 Plates, 5 Tab.

Descriptors: *Colorado, *Floods, *Flood flow, *Indirect flood measurement, *Flood forecasting, *Flood profiles, *Historic floods, *Flood data, *Flood stages, *Peak discharge, *Flood peak, *Flood protection, *Non-structural alternatives, *Flood plain insurance, *Yampa River(CO), *Craig(CO), River flow, Flood damage, Rivers, Floodways, Flood plains, Channels, Ice jams, Control structures, Levee, Channel improvement, 100-year flood, 500-year flood, Fortification Creek(CO), Brotherton Gulch(CO), Cedar Mt Gulch(CO), Pine Ridge Gulch(CO), Moffat County(CO).

The study area covered by this report includes 7 miles of the Yampa River and the lower reaches of its tributaries--Fortification Creek, and Brotherton, Cedar Mt. and Pine Ridge Gulches--in and around Craig, CO. The drainage area for the Yampa River is 2130 square miles and for the tributaries a combined area of 272 square miles. Development in the flood plain is mainly agricultural and grazeland. New development consists of construction related to energy production. Flooding is caused by rapidly melting snow augmented by general rain from March to June and caused by ice jams in late Winter and early Spring. Obstructions to floodflow consist of natural vegetation and bridges and culverts. Major floods have occurred a number of times, most recently in 1947 and 1974. The largest floodflow was recorded during the 1947 flood and was 841 cubic feet per second (cfs). For the 100-year flood and 500 year flood, peak flow for the Yampa River would be 18,300 and 29,000 cfs, respectively. On fortification Creek, peak flows would be 3,600 and 12,400 cfs, respectively. Average velocities for the 100-year flood would be 5 feet per second for the Yampa River and 6 feet per second for Fortification Creek in their main channels. Following the 1947 flood emergency flood control work consisted of channel improvement and the construction of low, soil-type levees. No formalized flood control projects are in effect. Both the City of Craing and Mofffat County are eligible for Flood insurance under the emergency phase of the National Flood Insurance Program and both jurisdictions have adopted resolutions assuring implementation of a suitable flood plain management program. (Iervolino-NC)
W80-01414

FLOOD HAZARD INFORMATION: COLORADO RIVER AND TRIBUTARIES, GRAND JUNCTION, COLORADO,
Army Engineer District, Sacramento, CA.
Prepared for City of Grand Junction and Mesa County, CO, November 1976. 11 p, 74 Plates, 5 Tab

Descriptors: *Colorado, *Floods, *Flash flood, *Indirect flood measurement, *Flood stages, *Peak discharge, *Flood peak, *Non-structural alternatives, *Flood plain zoning, *Colorado River(CO), *Grand junction(CO), *Mesa County(CO), Flood flow, River flow, Flood forecasting, Storms, Cloudbursts, Historic floods, Flood data, Flood damage, Erosion, Rivers, Floodways, Flood plains, Flood protection, Land use, Zoning, Control structures, Levee, Dikes, 100-year flood, 500-year flood.

This report covers 12 miles of the Colorado River and a combined 12 miles of the Gunnison River, Leach Creek, Lewis Wash and Horizon Drive Channel, all tributaries of the Colorado River in the vicinity of Grand Junction, Mesa County, CO. The drainage area of the study length of the Colorado River is 17,100 square miles and for the tributaries is a combined 7,962 square miles. The area is extensively irrigated with much of the rural land in agricultural development. Floods in the area are caused by rapidly melting snow in spring and early summer and from intense rainfall from cloudburst storms. Obstructions to floodflow are natural vegetation and bridges and culverts. The most severe flood in Grand Junction occurred in 1884; the largest recorded flow on the Gunnison River was in May 1920. Recent floods were recorded in 1935, 1952, and 1957. For the 100-year flood the peak flow of the Colorado River below the mouth of the Gunnison River would be 82,000 cubic feet per second (cfs) and on the Gunnison River at Grand Junction the peak flow would be 20,000 cfs. At the same locations the 500-year flood peak flow for the Colorado River would be 107,000 cfs, and for the Gunnison River, 25,000 cfs. Emergency flood damage protection is provided by levees and low dikes. Reservoirs in the area are mainly for water conservation and provide only incidental flood protection. Mesa County adopted flood plain regulations and has incorporated designated flood plans into county zoning maps, including low hazard and floodway zones. (Iervolino-NC)
W80-01415

COASTAL FLOOD OF FEBRUARY 7, 1978, IN MAINE, MASSACHUSETTS, AND NEW HAMPSHIRE,
Geological Survey, Boston, MA. Water Resources Div

R. A. Gadoury.
Geological Survey Water-Resources Investigations 79-61 (open-file report), 1979. 57 p, 8 Fig, 2 Plates, 2 Tab, 9 Ref.

Descriptors: *Floods, *Flood damage, *Maine, *Massachusetts, *New Hampshire, Coasts, Storms, Tides, Winds, Ocean waves, High water mark, Seashores, Historic floods, Flood data, *Coastal floods.

On February 6-8, 1978, New England was battered by one of the most severe winter storms of record. The storm produced record snowfall in many areas of Rhode Island and Massachusetts. Spring high tides (sun and moon in such alinement as to cause the highest tides of the month), a stationary storm center, and hurricane force winds combined to produce record high flood levels along much of the Massachusetts to Maine coastline on February 7. Tidal gages recorded new highs of 10.4 feet in Boston, Massachusetts, and 9.6 feet in Portland, Maine. Fifty-four lives were lost because of the storm. Property damage was greatest along the Massachusetts coastline north of Cape Cod. The total cost of the storm--principally property damage, snow removal, and economic losses--approached $1 billion. This report contains data which document the flooding along parts of the New England coast. Elevations of 203 floodmarks in Massachusetts, 104 in Maine, and 46 in New Hampshire are given. Also included are some historical coastal flood data and a list of other storm-related studies. (Woodard-USGS)
W80-01420

SMALL-STREAM FLOOD INVESTIGATIONS IN MINNESOTA, OCTOBER 1958 TO SEPTEMBER 1977, WITH FLOODS FROM SELECTED LARGER DRAINAGE AREAS,
Geological Survey, St. Paul, MN. Water Resources Div.
G. H. Carlson, and K. T. Gunard.
Geological Survey open-file report 79-1061, 1979. 194 p, 9 Fig, 1 Tab, 7 Ref.

Descriptors: *Floods, *Streamflow, *Small watersheds, *Minnesota, *Peak discharge, Flow characteristics, Drainage area, Topography, Vegetation, Flood frequency, Gaging stations, Stage-discharge relations, *Basin characteristics.

An investigation of flood flows from small drainage basins in Minnesota is being made to aid in the design of bridges, culverts and other highway drainage structures. Results of the investigation provide peak-flow data on streams generally with drainage areas less than 50 square miles, placing particular emphasis on those with drainage areas less than 10 square miles. Basin parameters being investigated for their effect on floods are drainage area, length of main stream, slope of main channel, basin altitude, forest cover, and storage area. All the 163 gaging stations included in the report are equipped with crest-stage gages, and 10 stations are equipped to record stage and precipitation continuously. The relative magnitude of flood flows for different hydrologic regions is shown in graphs that relate maximum discharge to drainage area. Station records contain location, drainage area, records available, type of gage, on-site structure elevations, bankfull stage, and annual maximum stage and discharge data. The data form the basis for statewide flood-frequency studies. (Woodard-USGS)
W80-01432

FLOODS IN CENTRAL TEXAS, AUGUST 1978,
Geological Survey, Austin, TX. Water Resources Div.
E. E. Schroeder, B. C. Massey, and K. M. Waddell.
Geological Survey open-file report 79-682, April 1979. 121 p, 18 Fig, 6 Tab, 6 Ref.

Descriptors: *Floods, *Flood discharge, *Storms, *Peak discharge, *Flood damage, Rainfall-runoff relationships, Flood data, Streamflow, Flow rates, Gaging stations, Flood frequency, Historic floods, Water quality, Texas, *Tropical storm Amelia(1978).

Catastrophic floods, which resulted in millions of dollars in property damages and the loss of 33 lives, occurred in Central Texas during August 1-4, 1978, as a result of intense rainfall produced by tropical storm Amelia. Rainfall in excess of 30 inches was unofficially reported at several locations, while the highest 24-hour amount recorded by the National Weather Service was 29.05 inches at Albany in Shackelford County. Major flooding occurred on the Media River and tributaries above Medina Lake and on the Guadalupe River and tributaries above Canyon Lake. Minor to severe flooding occurred on the tributaries of the Nueces River, on the Clear Fork Brazos River and tributaries, and on the Llano and Pedernales Rivers, which are tributaries of the Colorado River. Peak discharges at several streamflow stations exceeded the historic peaks, and the flood magnitude and frequency data for the Guadalupe River above Canyon Lake, the Medina River near Pipe Creek, and Clear Fork Brazos River indicate that the August 1978 flood had a recurrence interval in excess of 100 years. The highest unit discharge observed during this flood was 3,010 cubic feet per second from a 14.1-square-mile drainage area of Spring Creek, which is tributary to the Pedernales River. (Woodard-USGS)
W80-01440

THE EFFECT OF MAINTENANCE ON STORM WATER DETENTION BASIN EFFICIENCY,
Maryland Univ., College Park. Dept. of Civil Engineering.
G. E. Kamedulski, and R. H. McCuen.
Water Resources Bulletin, Vol. 15, No. 4, p 1146-1152, August 1979. 3 Tab, 8 Ref. OWRT A-047-MD (2), 14-34-0001-8022.

Descriptors: *Storm water, *Urban runoff, *Basins, Floods, Flood control, Sediments, Sediment control, Maintenance, Effects, Sedimentation, Vegetation, Vegetation effects, Runoff, Storm runoff, Hydrology, Urbsan hydrology, *Detention basins, Detention.

Storm water detention is an effective and popular method for controlling the effects of increased urbanization and development. Detention basins are used to control both increases in flow rates and sedimentation. While numerous storm water management policies have been proposed, they most often fail to give adequate consideration to maintenance of the basin. Sediment accumulation with time and the growth of grass and weeds in the emergency spillway are two maintenance problems. A model that was calibrated with data from a storm water detention basin in Montgomery County, Maryland, was used to evaluate the effect of maintenance on the efficiency of the detention basin. Sediment accumulation in the basin caused the peak reduction factor to decrease, while accumulation increased as vegetation growth in the emergency spillway increased. Thus, the detention basin will not function as intended in the design when the basin is not properly maintained. Thus, maintenance of detention basins should be one component of a comprehensive storm water management policy. (Sims-ISWS)
W80-01582

FLOOD HYDROLOGY OF BUTTE BASIN, 1973-77 WATER YEARS, SACRAMENTO VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. G. Simpson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 454. Price Codes: A09 in paper copy, A01 in microfiche. Geological survey Water-Resources Investigations 78-86, October 1978. 70 p, 24 Fig, 8 Tab, 11 Ref.

Descriptors: *Floods, *California, *Streamflow, *Flood profiles, *Flood stages, Data collections, Gaging stations, Peak discharge, Flow rates, Flow characteristics, Water levels, Streams, *Butte Basin(CA), *Sacramento Valley(CA), *Sacramento River(CA).

Flooding in Butte Basin, CA., is caused primarily by overflow from the Sacramento River on the western boundary. Stage and discharge data were collected during 1973-77 at 6 recording and 45 crest-stage gages within the basin and combined with discharge records on the main channel of the Sacramento River to determine total flow and flow distribution at the latitudes of Ord Ferry, Butte City, and Gridley Road. Water-surface profiles throughout the basin, inflow/change-in-storage/outflow relations of the Butte Sink, and channel changes of the Sacramento River are shown. During 1973-77, total peak flows decreased an average of 7 percent between the latitudes of Ord Ferry and Butte City, with measured peaks from 100,000 to 200,000 cfs (cubic feet per second). The largest floodflow measured was 195,000 cfs on January 17, 1974, at the latitude of Ord Ferry. For a given flood, overland flow did not change significantly in peak magnitude between Afton Boulevard, Butte City, and Gridley road. Overland flows of about 45,000 and about 24,000 cfs were measured on January 18 and April 1, 1974, respectively. (Woodard-USGS)
W80-01589

2F. Groundwater

OUTCROP STUDY OF A COMPLEX SAND AQUIFER TO AID IN THE INTERPRETATION OF SUBSURFACE DATA,
Mississippi State Univ., Mississippi State.
D. M. Keady, and T. W. Lins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112725, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, Report, October 1979. 20 p, 10 Fig. OWRT-A-119-MISS (1), 14-34-0001-9026.

Descriptors: *Sand aquifers, *Sedimentary structures, *Facies(Sedimentary), Beds(Stratigraphic), Mississippi, *Meridian-upper Wilcox aquifer system, Meridian Sand, Hatchetigbee Formation, Outcrop study.

Outcrop study of sedimentary sequences in central and eastern Mississippi equivalent to the down-dip Meridian-upper Wilcox aquifer system demonstrates that the sands were deposited in different depositional settings. The true Meridian sand was deposited as shoals in a sand-deficient environment during slow transgression of a sea. The time-equivalent Hatchetigbee sands northwest of the Meridian area also consist of shoal sands, but were deposited in a series of step ups during a more rapid transgression in an area receiving more sand from a different source. Both sands are characterized by similar sedimentary structures--large amplitude, tabular crossbeds succeeded vertically by small amplitude, tabular cross beds. The Meridian sands contain glauconite, marine burrows, and quartzite granules, which are not present in the Hatchetigbee sands. Northwest of the area of Hatchetigbee step up the stratigraphic interval studied becomes dominated by sands of fluvial origin. Regionally, in the subsurface, the Meridian sands were deposited over delta-margin facies, whereas the sands of the Hatchetigbee step up were deposited over deltaic facies. An understanding of the depositional setting and depositional environments of the aquifer system can be of considerable value to those involved in the exploration of ground water.
W80-01260

AN APPLICATION OF A METHOD FOR COMPARING ONE-DIMENSIONAL AND TWO-DIMENSIONAL MODELS OF A GROUNDWATER FLOW SYSTEM,
California Univ., Livermore, Lawrence Livermore Lab.
T. G. Naymik.
Available from the National Technical Information Service, UCRL-52541, Price codes: A03 in paper copy, A01 in microfiche. Report UCRL-52541, 1978. 28 p, 19 Fig, 4 Tab, 3 Ref, 1 Append.

Descriptors: *Hydraulic gradient, *Model studies, *Groundwater movement, Mathematical studies, Geohydrologic units, Nuclear wastes, Waste disposal, Aquifers, Flow, Porosity, Hydraulic con-

ductivity, Travel time, One-dimensional models, Two-dimensional models.

To evaluate the inability of a one-dimensional groundwater model to interact continuously with surrounding hydraulic head gradients, simulations using one-dimensional and two-dimensional groundwater flow models were compared. This approach used two types of models: flow-conserving one-and-two dimensional models, and one-dimensional and two-dimensional models designed to yield two-dimensional solutions. The hydraulic conductivities of controlling features were varied, and model comparison was based on the travel times of marker particles. The solutions within each of the two model types compared reasonably well, but a three-dimensional solution was required to quantify the comparison. (Visocky-ISWS)
W80-01296

GROUND-WATER AVAILABILITY IN TEXAS, ESTIMATES AND PROJECTIONS THROUGH 2030,
Texas Dept. of Water Resources, Austin.
D. A. Muller, and R. D. Price.
Report 238, September 1979. 84 p, 12 Fig, 7 Tab, 104 Ref, 2 Append.

Descriptors: *Groundwater availability, *Texas, *Aquifers, *Projections, *Groundwater, Estimating, Hydrologic cycle, Hydrogeology, Data collections, Groundwater resources, Aquifer characteristics, Model studies, Water quality, Water supply, Groundwater recharge, River basins, Annual, Alluvial aquifers, Analysis, Analytical techniques.

The purpose of this report was to present information on the quantity of groundwater available in the State of Texas on an average annual basis through the year 2030. The study provided estimates of the amounts of effective recharge and the amounts of water that can be recovered from storage for selected aquifers in the State. This appraisal re-evaluated and updated the groundwater availability data of the major and minor aquifers as presented in the 1968 Texas Water Plan and considered additional aquifers where pertinent information has been obtained. The scope of the study encompassed the collection, compilation, and analysis of data relating to groundwater availability such as: determination of the regional and statewide location and extent of the major and minor aquifers; the available annual effective recharge to each aquifer; computation by best available methods of the amount of groundwater in storage that is available for development in selected aquifers; and incorporation of results from using digital mathematic computer models of the Ogallala, Carrizo-Wilcox, Edwards (Balcones Fault Zone), Hueco Bolson, and Gulf Coast aquifers. The average annual groundwater availability from the major and minor aquifers in the State of Texas ranges from approximately 10.2 million acre-feet in 1980 to 8.4 million acre-feet in the year 2030. These estimates utilize 5.1 million acre-feet as annual effective recharge, and the remainder is groundwater recoverable from storage in particular aquifers. Current appraisals indicate that approximately 397.6 million acre-feet is in total storage in these particular aquifers, of which about 327.8 million acre-feet is considered to be recoverable. (Humphreys-ISWS)
W80-01297

OCCURRENCE, AVAILABILITY, AND CHEMICAL QUALITY OF GROUND WATER IN THE EDWARDS PLATEAU REGION OF TEXAS,
Texas Dept. of Water Resources, Austin.
L. E. Walker.
Report 235, July 1979. 346 p, 21 Fig, 8 Tab, 97 Ref, 17 Maps.

Descriptors: *Texas, *Groundwater, *Water quality, *Data collections, *Aquifers, Groundwater availability, Census, Water properties, Chemical analysis, Geologic formations, Aquifer characteristics, Maps, Groundwater resources, Dissolved solids, Brines, Oil, Water wells, Well data, Geology, Water levels, Springs, Water supply, Water utilization, Water yield, Municipal water, Domestic water, Industrial water, Irrigation water, Livestock, *Edwards Plateau(TX), Chemical quality.

The scope of the study included the collection and compilation of all available data pertaining to the occurrence, availability, and chemical quality of water in the Edwards-Trinity (Plateau) aquifer and other aquifers on the Edwards Plateau. The plateau is located in southwest Texas and lies between 98 deg and 103 deg west longitude and 29 deg and 32 deg north latitude. The area composes approximately 23,000 square miles and includes all or parts of 28 counties. The region is bounded on the west by the Pecos River; on the north, northwest, and northeast by the physical limit of the Cretaceous rocks; on the east by the Llano uplift; on the south and southeast by the Balcones fault system; and on the southwest by the Rio Grande. The principal aquifers, or water-bearing units, in order of importance and development are the Edwards-Trinity (Plateau), composed of the Antlers Formation and the Edwards and associated limestones; the alluvium; the lower Cretaceous, composed of the Hosston, Sligo, Pearsall, and Glen Rose Formations; the Hickory; and the Ellenburger-San Saba. Other units that yield fresh to slightly saline water in limited areas on or near the Edwards Plateau are the Ogallala aquifer and rocks of Pennsylvania, Permian, and Triassic age. The total amount of fresh to slightly saline groundwater available from all the aquifers on the Edwards Plateau is more than 450,000 acre-feet per year. Water levels are declining in the Edwards-Trinity (Plateau) aquifer in areas of heavy pumping in Ector, Glasscock, Midland, Reagan, and Upton Counties. The water is generally very hard, but treatment methods can be used to remove calcium carbonate. Other undesirable dissolved minerals such as sulfate, chloride, and fluoride are present in varying amounts in water from the Antlers Formation; however, the water has been used for most purposes without apparent harmful results. (Humphreys-ISWS)
W80-01298

RECORDS OF WELLS, CHEMICAL ANALYSES, AND WATER LEVELS OF SELECTED EDWARDS WELLS, BEXAR COUNTY, TEXAS,
Texas Dept. of Water Resources, Austin.
G. L. Marquardt, and G. R. Elder.
Report 237, July 1979. 461 p, 2 Fig, 4 Tab, 17 Ref.

Descriptors: *Texas, *Groundwater, *Water wells, *Basic data collections, *Well data, Water properties, Dissolved solids, Hardness(Water), Salts, Chemical analysis, Water quality, Water levels, Water yields, Hydrogen ion concentration, Silica, Iron, Calcium, Magnesium, Sodium, Potassium, Carbonates, Sulfates, Chlorides, Nitrates, Boron, Fluorides, *Bexar County(TX), *Edwards Aquifer(TX), Water well locations.

This report contained basic data on selected wells in Bexar County, Texas, including well-location map, records of 694 water wells, records of water levels in 119 wells, and chemical analyses of water samples from 204 wells. All of the wells selected for this report are high-capacity wells completed in the Edwards (Balcones Fault Zone) aquifer, except for 6 wells which are lacking completion data but do have long-term records of water-level measurements. The term 'high-capacity wells' as used in this report implies wells capable of yielding in excess of 500 gallons per minute. The wells can also be categorized as active or inactive. The inactive wells are those which presently are not being used but could be placed on active status within a short time. Also included in the record of wells, because of their importance as stratigraphic control points, are plugged wells that have been logged by mechanical methods. Logs of those wells are available for reference in the files of the Texas Department of Water Resources. (Humphreys-ISWS)
W80-01299

GROUND-WATER AVAILABILITY IN PARTS OF THE CHICOPEE AND MILL RIVER BASINS, NEAR WILBRAHAM, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
D. F. Delaney.
Geological Survey Water-Resources Investigations 79-72 (open-file report), 1979. 1 Sheet, 14 Ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Subsurface mapping, *Hydrogeology, *Aquifers, Bedrock, Till, Glacial drift, *Wilberham(MA), *Chicopee River Basin(MA), *Wilbraham River Basin(MA).

Ground water in the Wilbraham area occurs in glacial drift and in underlying bedrock. Stratified sand and gravel deposits form the principal unconsolidated aquifers. These aquifers are generally less than 50 feet thick in most of the study area; however, an area in north-central Wilbraham, near the Chicopee River, is underlain by stratified drift deposits more than 200 feet thick that may be capable of yielding more than 300 gal/min (gallons per minute) to individual wells. Bedrock aquifers are generally of two types: Triassic and Jurassic sedimentary rock lies west of a north-south trending fault, and Paleozoic metamorphic, and igneous rock lies east of the fault. The median yield of wells in sedimentary bedrock is 15 gal/min; yields range from 2 to 110 gal/min. The median yield of wells in crystalline rock is 5 gal/min; yields range from less than 1 to 60 gal/min. (Woodard-USGS)
W80-01424

PRELIMINARY DATA FOR MADISON LIMESTONE TEST WELL 3, NW1/4 SE1/4 SEC. 35, T. 2 N., R. 27 E., YELLOWSTONE COUNTY, MONTANA,
Geological Survey, Denver, CO. Water Resources Div.; Geological Survey, Huron, SD. Water Resources Div.; Geological Survey, Billings, MT. Water Resources Div.
R. K. Blankennagel, L. W. Howells, W. R. Miller, and C. V. Hansen.
Geological Survey open-file report 79-745, June 1979. 186 p, 7 Fig, 3 Plates, 3 Tab, 5 Ref

Descriptors: *Groundwater resources, *Potential water supply, *Test wells, *Water quality, *Montana, Data collections, Hydrogeology, Borehole geophysics, Cores, Drillers logs, Well data, Aquifer testing, Geochemistry, Chemical analysis, Groundwater availability, Limestones, *Yellowstone County(MT), *Madison limestone, Northern Great Plains

This report provides preliminary data for Madison Limestone test well 3 in Yellowstone County, Mont., including test-well history, geology of the test well, hydrologic testing, and geochemistry. It also discusses the preliminary results and future testing. The test well was drilled as part of the study to determine the water-resource potential of the Madison Limestone and associated rocks to meet future water needs in a 188,000-square-mile region that includes the coal-rich area of the Northern Great Plains. Drilling and testing were designed to yield a maximum of stratigraphic, structural, geophysical, and hydrologic information. (Woodard-USGS)
W80-01434

APPROXIMATE ALTITUDE OF WATER LEVELS IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS IN THE HOUSTON AREA, TEXAS, SPRING 1977 AND SPRING 1978,
Geological Survey, Houston, TX. Water Resources Div.
R. K. Gabrysch.
Geological Survey open-file report 79-334, February 1979. 4 Sheets.

Descriptors: *Groundwater, *Water wells, *Water levels, *Potentiometric level, *Maps, Contours, Aquifers, Texas, *Houston area(TX), Chicot aquifer, Evangeline aquifer.

Four maps show water levels in wells in the Houston, Texas, area in (1) the Chicot aquifer, spring 1977; (2) the Evangeline aquifer, spring 1977; (3) the Chicot aquifer, spring 1978; and (4) the Evangeline aquifer, spring 1978. Both the Chicot and Evangeline aquifers are composed of several sand layers with different potentiometric surfaces.

These maps, however, show approximations of single potentiometric surfaces that represent composite hydraulic heads. (Woodard-USGS)
W80-01437

IDENTIFICATION OF AQUIFER DISPERSIVITIES IN TWO-DIMENSIONAL TRANSIENT GROUNDWATER CONTAMINANT TRANSPORT: AN OPTIMIZATION APPROACH,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
A. Umari, R. Willis, and P. L-F. Liu.
Water Resources Research, Vol 15, No 4, p 815-831, August 1979. 3 Fig, 10 Tab, 26 Ref, 1 Append.

Descriptors: *Aquifers, *Hydraulic properties, *Unsteady flow, *Mass transfer, *Optimization, Water pollution, Wastes, Aquifer characteristics, Computer models, Porosity, Velocity, Seepage, Finite element analysis, *Dispersivity, *Inverse problem, Transport.

The problem of identifying unknown aquifer dispersivities in two-dimensional transient groundwater contaminant transport from given observations on the concentration field was addressed. This inverse problem was formulated as a general nonlinear programming problem, the purpose of which is to minimize the discrepancy between calculated and observed values of the concentration field. The method of quasilinearization was used to linearize the above problem, and the inverse algorithm becomes the solution of a sequence of linear programs that converge to the solution of the original nonlinear problem. The finite elements method in conjunction with finite differencing was used to discretize the governing differential equations which were then used as constraints for the optimization (mathematical programming) problem stated above. The effect on the inverse problem of the choice of observation points, objective function, number of finite elements, size of time step, and observation errors was studied. The proposed identification algorithm was shown to be fast, stable, and accurate. (Visocky-ISWS)
W80-01449

LONG-TERM WATER SUPPLY POTENTIAL, GREEN SWAMP AREA, FLORIDA,
Geological survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-01588

GROUND WATER IN THE VICINITY OF CAPULIN, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 6D.
W80-01592

LOW-FLOW CHARACTERISTICS OF STREAMS IN THE LAKE SUPERIOR BASIN, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
W. A. Gebert.
Geological Survey Water-Resources Investigations 79-38 (open-file report), April 1979. 74 p, 6 Fig, 3 Plates, 3 Tab, 15 Ref.

Descriptors: *Low-flow, *Streamflow, *Low-flow frequency, *Base flow, *Flow duration, Equations, Regression analysis, Analytical techniques, *Lake Superior basin(Wis).

Low-flow characteristics of streams in the Lake Superior basin include estimates of low-flow frequency and flow duration at 9 gaging stations, low-flow frequency at 16 low-flow partial-record stations and 38 miscellaneous sites; and a list of base-flow discharge measurement is available. The equations were determined from multiple-regression analyses that relate low-flow characteristics. The standard error of estimate is provided for each method of estimating the annual minimum 7-day mean flow below which the flow will fall on the average of once in 2 years and once in 10 years. Standard error provides the user with the expected degree of accuracy for each method. (Woodard-USGS)
W80-01596

HYDROGEOLOGIC DATA FOR THE EAGLE RIVER-CHUGIAK AREA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
P. Johnson.
Geological Survey Water-Resources Investigations 79-59 (open-file report), 1979. 17 p, 2 Fig, 1 Tab, 1 Ref.

Descriptors: *Hydrology, *Groundwater resources, *Aquifer characteristics, *Water yield, Water levels, Water wells, Well data, Hydrologic data, Maps, Alaska, *Eagle-River-Chugiak area(Alaska).

Water for the Eagle River-Chugiak area, Alaska, is provided by private, subdivision and trailer court wells. Data from these wells were studied to determine aquifer materials, yield, well depth and depth to water. The aquifer material is unconsolidated glacial or alluvial gravel and sand and bedrock from the McHugh Complex, the unnamed metamorphic complex and the Kenai Formation. The median well yield for bedrock wells is 2 gallons per minute and the median well yield for wells completed in unconsolidated aquifers is 10 gallons per minute. Well depths may vary widely where wells are drilled into bedrock or glacial till but are more uniform where wells are drilled into alluvial gravels and sand. A continuous water table is not defined in the Eagle-Chugiak area. (Woodard-USGS)
W80-01597

2G. Water In Soils

STRUCTURE AND CHEMISTRY OF THE FISHPOND BOTTOM,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
D. Dykyjova, and B. Ulehlova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 141-152, 1978. 8 Fig, 4 Tab.

Descriptors: *Ponds, *Soil analysis, *Muck soils, *Soil chemistry, Wetlands, Freshwater marshes, Peat, Organic matter, Soil types, Mud.

In the Trebon basin, Czechoslovakia, unsaturated freshwater marsh soils occur on acid sand, clay, or peat and in some places on transitional types to more base-saturated subsoils. Owing to intense decomposition and mineralization of organic material, the water is nutrient-richer in the vegetated littoral than in the open pelagial. The bottom and water chemistry of the reed belt depend on the shore configuration and wave motion, so that two essentially different kinds of fishpond habitats or zones occur: the accumulation and the erosion zone. Two main types of submerged soils occur in the Opatovicky fishpond, Czechoslovakia: (1) unsaturated sandy soils of mineral origin with blue-grey impermeable clay layer in the subsoil and (2) pseudo-gleys or semigleys prevailing on clay subsoil. Typical rusty dots and veins of precipitated Fe +3 occur in the gleyic layers around the fine roots of the emergent plants. In sheltered bays, especially on the eastern shore, large amounts of organic detritus are accumulated, giving rise to deep layers of humic organic soils gradually filling the bays. (See also W80-01209) (Steiner-Mass)
W80-01221

MEASURING HYDRAULIC CONDUCTIVITY IN CLAY SOILS: METHODS, TECHNIQUES, AND ERRORS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
For primary bibliographic entry see Field 7B.
W80-01265

THE DIFFUSION AND NONEQUILIBRIUM THERMODYNAMIC EQUATIONS OF WATER VAPOR IN SOILS UNDER TEMPERATURE GRADIENTS,
Tokyo Univ. (Japan); and Shikoku National Agricultural Experiment Station.
M. Nakano, and T. Miyazaki.
Soil Science, Vol 128, No 3, p 184-188, September 1979. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Diffusion, *Water vapor, *Soils, *Soil temperature, *Thermal properties, Equations, Mathematical models, Theoretical analysis, Pores, Gases, Soil water movement, Density, Moisture content. *Ficks law, Temperature gradient, Air density gradient, Transport.

Based on the observation that temperature is a function of distance, Fick's law of diffusion was extended as widely as possible to apply to the movement of water vapor in soils under temperature gradients. The general equations developed as a result were expressed using (1) water vapor pressure, (2) water vapor density, (3) the Clapeyron equation, and (4) the form of phenomenological equations in nonequilibrium thermodynamics. From comparisons with the equations derived in several previous reports, it was concluded that the earlier results may be valid only under the condition that the total water potential is larger than 0.000001 centimeters. (Visocky-ISWS)
W80-01266

EFFECT OF SURFACE ROUGHNESS ON THE MICROWAVE EMISSION FROM SOILS,
Computer Sciences Corp., Silver Spring, MD.
For primary bibliographic entry see Field 7B.
W80-01277

FLOW NET FOR UNSATURATED INFILTRATION FROM STRIP SOURCE,
Karadeniz Teknik Univ., Trabzon (Turkey). Dept. of Civil Engineering and Architecture.
V. Batu.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR 3, Proceedings Paper No 14822, p 233-245, September 1979. 3 Fig, 30 Ref, 2 Append.

Descriptors: *Infiltration, *Potential flow, *Unsaturated flow, *Groundwater recharge, *Mathematical models, Groundwater movement, Analysis, Flow nets, Hydrodynamics, Permeability, Steady flow, Seepage, Streamlines, Stream function, Equi-potential lines.

The steady-state, unsaturated flow equation linearized by using the Kirchhoff transformation with an exponential relationship between unsaturated hydraulic conductivity and soil water pressure was solved for the two-dimensional case. A general equation in integral form was obtained for the stream function under a variable infiltration rate from a strip located on the soil surface. The total potential functions were derived using the matrix-flux potential distributions. Several graphical flow nets were presented for different soil parameters. Comparisons between the saturated and unsaturated streamlines were made, and it was concluded that the discrepancies increase with decreasing water content in the flow field. (Adams-ISWS)
W80-01281

MOBILIZATION AND ACCUMULATION OF HEAVY METALS IN FRESHWATER WETLANDS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5G.
W80-01379

GROUND FREEZING,
For primary bibliographic entry see Field 2C.
W80-01498

EFFECTS OF TEMPERATURE AND PRESSURE ON FROST HEAVING,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
For primary bibliographic entry see Field 2C.
W80-01499

EFFECTS OF INITIAL SOIL-WATER CONDITIONS ON FROST HEAVING CHARACTERISTICS,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 2C.
W80-01500

FROST HEAVE OF UNSATURATED LOAMY SOIL UNDER FIELD CONDITIONS,
Leningrad Inst. of Constructional Engineers (USSR).
For primary bibliographic entry see Field 2C.
W80-01501

EFFECT OF THE RATE OF HEAT REMOVAL ON THE RATE OF FROST HEAVING,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 2C.
W80-01502

EFFECT OF FREEZING AND THAWING ON THE PERMEABILITY AND STRUCTURE OF SOILS,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W80-01503

SEGREGATION FREEZING AS THE CAUSE OF SUCTION FORCE FOR ICE LENS FORMATION,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W80-01504

EQUATIONS OF FROST PROPAGATION IN UNSATURATED POROUS MEDIA,
Laboratoire Central des Ponts et Chaussees, Paris (France).
For primary bibliographic entry see Field 2C.
W80-01505

THE EFFECT OF ITERATION FREQUENCY ON A NUMERICAL MODEL OF NEAR-SURFACE ICE SEGREGATION,
Michigan Univ., Ann Arbor. Dept. of Geography.
For primary bibliographic entry see Field 2C.
W80-01506

CRYOGENIC TEXTURE AND STRENGTH ASPECTS OF ARTIFICALLY FROZEN SOILS,
Rutgers-The State Univ., New Brunswick, NJ. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2C.
W80-01507

PREDICTION OF SALT INFLUENCE ON UNFROZEN WATER CONTENT IN FROZEN SOILS,
McGill Univ., Montreal (Quebec). Geotechnical Research Centre.
For primary bibliographic entry see Field 2C.
W80-01508

UNFROZEN WATER AS A FUNCTION OF CLAY MICROSTRUCTURE,
Lulea Univ. (Sweden). Div. of Soil Mechanics.
For primary bibliographic entry see Field 2C.
W80-01509

INTERRELATIONSHIP OF THE PRINCIPAL PHYSIOCOMECHANICAL AND THERMOPHYSICAL PROPERTIES OF COARSE-GRAINED FROZEN SOILS,
Kuybyshevskii Inzhenero-Stroitelnyi Inst. (USSR). Frozen Soil Science and Power Plant Construction Branch Research Lab.
For primary bibliographic entry see Field 2C.
W80-01510

EFFECT OF FREEZE-THAW CYCLES ON RESILIENT PROPERTIES OF FINE-GRAINED SOILS,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W80-01517

PRESSURE OF THAWING SOILS ON THE CONCRETE LINING OF VERTICAL MINE SHAFTS,
Research Inst. of Bases and Underground Structures, Gosstroi (USSR).
For primary bibliographic entry see Field 2C.
W80-01518

THERMAL AND RHEOLOGICAL COMPUTATIONS FOR ARTIFICALLY FROZEN GROUND CONSTRUCTION,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W80-01521

STABILITY OF MINE WORKINGS IN FROZEN SOILS,
Research Inst. of Bases and Underground Structures, Gosstroi (USSR).
For primary bibliographic entry see Field 2C.
W80-01522

STRENGTH ANALYSIS OF THE FROZEN-GROUND ENCLOSURE OF A LOW-TERMPERATURE STORAGE RESERVOIR FOR LIQUEFIED GASES,
All-Union Research Inst. for the Utilization of Gas in the Economy and for the Underground Storage of Oil, Oil Products and Liquefied Gases, Moscow, (USSR).
For primary bibliographic entry see Field 8D.
W80-01524

DESIGN OF TUNNEL SUPPORT SYSTEMS USING GROUND FREEZING,
Law Engineering Testing Co., McLean, VA.
J. S. Jones, and R. E. Brown.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 375-395, April 1979. 10 Fig, 2 Tab, 25 Ref.

Descriptors: *Frozen soils, *Tunneling, *Frost heaving, *Tunnel construction, Freezing, Frozen ground, Laboratoty tests, Methodology, Mechanical properties, Stress analysis, Creep, Analytical techniques, Finite element analysis, Tunnel linings, Stress, Strain, Triaxial tests.

This paper described the general design considerations involved in the ground-freezing method. Various factors were discussed which influence the selection of the freezing temperature, the thickness of the frozen zones and the spacing of the freeze pipes. The time required to achieve freezing was discussed in addition to the amount and rate of frost heave caused by the freezing. To illustrate the applicability of the freezing method, varous considerations in the design of an 8-ft diameter tunnel in upstate New York, a 75-ft diameter tunnel in Georgia, and a 12.5-ft diameter tunnel in Washington, D.C., were discussed. The tunnels were to pass immediately beneath mainline railroad tracks. A laboratory testing program was implemented to determine the effects of the repetitive train loads on the zone of frozen soil around the tunnel perimeter. Stress-controlled repeated load triaxial tests were performed on both undisturbed and remolded samples frozen from temperatures of -7C for the New York tunnel to -10C for the Atlanta and Washington tunnels. It was found that there was little difference between the cumulative strain response from repeated load tests and static tests for the low frequencies investigated (1/4 to 1/2 cycles per minute). Hyperbolic stress-strain functions were developed to simulate the stress-strain relationship for various cummulative loading times. The stresses and strains in the frozen soil tunnel configuration were computed by the finite element method, using both linear and hyperbolic stress-strain functions. The analyses indicated that zones of frozen soil of approximately 3 ft thick were required for both the New York and Washington tunnels. However, high tensile stresses were calculated for the Atlanta tunnel, precluding the use of the freezing method. (See also W80-01498) (Humphreys-ISWS)
W80-01525

LARGE-SCALE FREEZING WORK FOR SUBWAY CONSTRUCTION IN JAPAN,
Tokyo Metropolitan Government (Japan).
For primary bibliographic entry see Field 8A.
W80-01526

THE SOIL-FREEZING METHOD FOR LARGE TUNNEL CONSTRUCTIONS,
Holzmann (Phillip) A. G., Frankfurt am Main (Germany, F.R.).
For primary bibliographic entry see Field 8A.
W80-01527

SUBWAY CONSTRUCTION IN STUTTGART UNDER PROTECTION OF A FROZEN SOIL ROOF,
Holzmann (Phillip) A. G. , Frankfurt am Main (Germany, F. R.).
For primary bibliographic entry see Field 8A.
W80-01528

GROUND FREEZING FOR SUPPORT OF OPEN EXCAVATIONS,
Terrafreeze Corp., Lorton, VA.
B. Braun, J. Shuster, and E. Burnham.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 429-453, April 1979. 7 Fig, 27 Ref.

Descriptors: *Frozen ground, *Excavations, *Construction, Freezing, Frozen soils, Refrigeration, Methodology, Monitoring, Design criteria, Costs, Groundwater, Sites, Equipment, Geology, Hydrology, Groundwater control, Refrigeration plants.

A practical discussion of critical factors for designing and constructing temporary frozen earth ground support and groundwater control systems for large open excavations was reported. Many construction projects require extensive subsurface work which can best be completed in a large open excavation, shaped to accommodate the subsurface structure. Frequently, lateral ground support of adjoining property and groundwater control within the excavation are major problems for completion of subsurface work. Construction ground freezing has now become an economically competitive solution for many such applications, particularly in bad ground. The general experience gained from completing ground freezing for numerous open excavation projects over the past 10 years was reported to assist in the evaluation, design, and construction of future projects. The principal emphasis of this report was the practical construction and field instrumentation procedures necessary successfully to complete ground freezing for a project. Examples from past projects ranging from large nuclear power plants to small sewerage pumping stations were employed to emphasize important points. (See also W80-01498) (Humphreys-ISWS)
W80-01529

GROUND FREEZING MONITORING TECHNIQUES,
International Versuchsanstalt for fuer Fels G.m.b.H., Bentheim (Germany, F.R.). Interfels.
D. Heinrich, G. Muller, and H. Voort.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 455-471, April 1979. 13 Fig, 1 Tab, 2 Ref.

Descriptors: *Frozen soils, *Monitoring, *Boreholes, *Logging(Recording), Instrumentation, Frozen ground, Frost heaving, Frost, Freezing,

Methodology, On-site tests, Measurement, Soil temperature, Temperature control, Surveys, Coolants, Vertical boreholes, Horizontal boreholes, Inclinometers.

Ground-freezing is used in mining and civil engineering to make water-bearing strata temporarily impermeable and to increase their compressive and shear strength by transforming joint water and interstitial water into ice. Freezing of rock or soil layers is achieved by means of an array of cased boreholes, through which a cold liquid is circulated in order to remove heat energy, comparable to cooling coils. Frost expansion from the boreholes into the ground is monitored for a better and more economic control of the freezing process. For this purpose, instruments for the determination of borehole deviation, for measurement of the temperature field, and for an assessment of the degree of freezing with ultrasonic waves have proved useful. These three techniques were described based on results obtained from field measurements. (See also W80-01498) (Humphreys-ISWS)
W80-01530

GROUND CONSOLIDATION WITH LIQUID NITROGEN (LN2),
Linde A.G., Hollriegelskreuth (Germany, F.R.). Technical Gases Div.
For primary bibliographic entry see Field 2C.
W80-01531

USES AND LIMITATIONS OF GROUND FREEZING WITH LIQUID NITROGEN,
Deilmann-Haniel G.m.b.H., Dortmund (Germany, F.R.).
For primary bibliographic entry see Field 2C.
W80-01532

JOINTING OF TWO TUNNEL SHIELDS USING ARTIFICIAL UNDERGROUND FREEZING,
Seiken Co., Ltd. Osaka (Japan).
T. Takashi, S. Kiriyama, and T. Kato.
In: Ground Feeezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 519-529, April 1979. 12 Fig.

Descriptors: *Tunneling, *Frozen soils, *Underground structures, *Freezing, Tunnel construction, Frozen ground, Methodology, On-site investigations, Sewers, Temperature control, Frost heaving, Soil temperature, Foreign countries, Sands, Brines, *Japan.

Freezing was used in the jointing section of two shields (diameter 3.14 m) which ran across at right angles and at 25-m depth under the crossing of main roads for construction of a 2.4-m diameter sewer tunnel. The object of freezing was to create a frozen barrier to prevent the inflow of water and fine sand into the area to be excavated. Thirty-five freeze pipes (length about 7 m) were placed from one shield conically in the direction of the flank of another shield with freeze pipes attached to its inside wall. The cooling unit was placed on unoccupied land at abourt 60 m distant from the jointing section, and the freeze pipes were connected with the cooling unit by supply and return pipelines. The cooling unit had a cooling capacity of 79,000 kcal/h at an evaporation temperature of -27C and a condensation temperature of 40C. Freezing was continued for 180 days, and the CaCl2 brine temperature was -25 to -30C. These works were accomplished without the sinking of shaft and the use of injection, in complete safety with no traffic restriction on the road surface. (See also W80-01498) (Humphreys-ISWS)
W80-01535

CONVERSION OF ABANDONED COLLIERIES IN SOUTHERN BELGIUM INTO LOW-PRESSURE GAS STORAGE UNITS, WITH DESCRIPTION OF SPECIAL PLUGGING OF THE VARIOUS SHAFTS,
N. V. Foraky SA., Brussels (Belgium).
E. F. J. Buttiens.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 531-539, April 1979. 3 Fig.

Descriptors: *Underground storage, *Frozen soils, *Coal mines, Mining, Shafts(Excavations), Construction, Freezing, Foreign countries, On-site investigations, Underground structures, Frozen ground, *Shaft closure, *Belgium, Gas storage, Abandoned shafts.

In the southern part of Belgium, in the province of Hainaut, several collieries have been dismantled and closed over the last 10 years. Geological conditions in this part of the country are advantageous for the construction of large storage units in the mine galleries which remained open. It is, therefore, necessary to evaluate this possibility, and also to plug the old mine shafts. The construction of gastight shaft-plugs able to withstand demolition charges was carried out with maximum safety precautions by artificially freezing the roof and floor above and beneath the plug. The application of this unique method in the concession of 'Bois de la Haye' was described. (See also W80-01498) (Humphreys-ISWS)
W80-01536

APPLICATION OF THE GROUND-FREEZING METHOD TO PENETRATE A SEQUENCE OF WATER-BEARING AND DRY FORMATIONS--THREE CONSTRUCTION CASES,
Thyssen Schachtbau G.m.b.H., Mulheim an der Ruhr (Germany, F.R.).
E. Rupprecht.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 541-546, April 1979. 3 Fig.

Descriptors: *Tunneling, *Adits, *Frozen soils, *Porous media, Construction, Boreholes, Saturated soils, Groundwater, Aquifers, Underground structures, Freezing, Methodology, Geology.

In large areas of the world, adits to underground caverns, mineral deposits, and other openings have to penetrate a sequence from surface to final depth of sweet-water-bearing ground, dry consolidated ground, and salt-water-bearing ground. The pressure of the salt water is approximately equal to the full hydrostatic head to surface. Contamination of the upper sweet water reservoir by the salt water is to be avoided during construction work and also after completion. Three construction cases were presented using different methods as follows: Case 1: The top formation is penetrated using the ground-freezing method; the dry formation is penetrated conventionally; and the salt-water-bearing formation is penetrated using the ground-freezing method. Special problem: Drilling freeze holes from a station in the dry formation into the high-pressure salt-water-bearing formation. Case 2: The entire sequence is penetrated using the ground-freezing method. Special problem: Abandonment of freeze holes to prevent salt-water migration from the lower aquifer to the sweet-water aquifer. Case 3: Freeze holes are drilled from surface and freeze pipes are set in the lower salt-water-bearing strata only; the top water-bearing formation is penetrated, using a dewatering system; the dry formation is penetrated conventionally; and the lower salt-water-bearing formation is penetrated using the ground-freezing method. Special problem: Installation of freeze pipes and preabandonment. (See also W80-01498) (Humphreys-ISWS)
W80-01537

DETERMINISTIC HYDROLOGIC MODELING OF GRAZING SYSTEM IMPACTS ON INFILTRATION RATES,
Utah State Univ., Logan. Watershed Science Unit.
G. F. Gifford, and R. H. Hawkins.
Water Resources Bulletin, Vol 15, No 4, p 924-934, August 1979. OWRT A-035-UTAH (3), 14-34-0001-8047.

Descriptors: *Infiltration rates, *Grazing, *Hydrologic aspects, *Forages, *Pasture management, Infiltration, Cattle, Sheep, Pastures, Ecology, Environmental effects, Grasslands.

The available literature on the effect of grazing intensity on infiltration rates was used as a basis for modeling the response of infiltration to grazing systems. Linear equations were developed relating infiltration rates to the grazing intensity and time. An example was included to demonstrate the use and limitations of the method. (Adams-ISWS)
W80-01544

2H. Lakes

POND LITTORAL ECOSYSTEMS
Springer-Verlag, Berlin, Heidelberg, New York, 1978. 464 p, 183 Fig. Dykyjova, D. 1nd Kvet, J., (eds).

Descriptors: *Freshwater marshes, *Littoral, *Ecosystems, Wetlands, Ponds, Marsh plants, Marsh management, Wildlife, Productivity, Decomposing organic matter, Nutrients, Biological communities, Conversation, *Czechoslovakia.

This fishpond littoral ecosystems were investigated in two biogeographical regions in Central Europe with a comparison between the environmental characteristics and functioning of the biotic components in the Trebon Basin (a reserve in Bohemia) and in the Lednice fishponds (a nature reserve in Moravia). Information includes structure, productivity, and production processes of the vegetation and its macrophytes and algae, decomposition processes and mineral nutrient regime in fishpond littorals, the role of certain animal populations, and management and conversation of fishpond littoral vegetation and waterfowl. (See W80-01210 thru W80-01251) (Steiner-Mass)
W80-01209

INTRODUCTION TO THE ECOLOGY OF FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Brno. Botanicky Ustav.
S. Hejny, and J. Kvet.
In: Pond Littoral Ecosystems: Springer-Verlag, New York, p 1-9, 1978. 2 Fig, 15 Ref.

Descriptors: *Farm ponds, *Ecology, Wetlands, Lakes, Water levels, Ponds, Fish farming, Impounded waters, Ecosystems.

By contrast to natural standing waters, a fishpond is a man-made complex ecosystem. As fishponds have mainly been constructed in wetland regions, their biotic communities do not differ substantially from those of the original natural wetland. A specific feature of fishponds is the possibility to drain or fill them up at any time if enough water is available. The actual position of the water level determines that distribution of ecophases along the bottom slope. The ecophases are to a large extent compatible with the frequently used limnological terms denoting zones of the littoral, as derived from the zonation observed on lake shores. (See also W80-01209) (Steiner-Mass)
W80-01210

GENERAL CHARACTERISTICS OF THE TREBON BASIN AND LEDNICE REGION,
Ceskoslovenska Akademie Ved, Brno. Botanicky Ustav.
S. Husak, and S. Hejny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 13-22, 1978. 5 Fig, 3 Tab.

Descriptors: *Farm ponds, *Geomorphology, *Ecology, Wetlands, Ponds, Fish farming, Impounded waters.

The Trebon Basin, originally an inaccessible wetland area, has been developed into a region of fish culture and forest plantations. The fishponds are filled with a naturally dystrophic water originating from large peatbogs. This water becomes highly eutrophicated through fertilization and manuring both of the fishpond water and surrounding cultivated land. In the Lednice region, the wetland is

abundant and constant. Water is supplied to the main Lednice fishponds by two brooks and by several smaller streams which usually dry out in the summer. There is no large stream in the area that would permanently ensure a sufficient water supply to these fish-ponds. They therefore often lack water. (See also W80-01209) (Steiner-Mass)
W80-01211

HIGHER PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved Botanicky Ustav.
For primary bibliographic entry see Field 2I.
W80-01212

ALGAL POPULATIONS RELATED TO DIFFERENT MACROPHYTE COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01213

AERIAL PHOTOGRAPHY AND MAPPING OF FISHPOND VEGETATION,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01214

ANIMAL POPULATIONS IN FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
For primary bibliographic entry see Field 2I.
W80-01215

DECOMPOSERS IN THE FISHPOND LITTORAL ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01216

DEVELOPMENT OF WETLAND AND AQUATIC VEGETATION IN THE TREBON BASIN SINCE THE LATE GLACIAL PERIOD,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01217

MICROCLIMATE IN FISHPOND LITTORAL ECOSYSTEMS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
P. Smid, and K. Priban.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 104-112, 1978. 4 Fig, 4 Tab.

Descriptors: *Farm ponds, *Littoral, *Microclimatology, *Environmental effects, Wetlands, Aquatic habitats, Decomposing organic matter, Microenvironment, Temperature, Marsh plants, Ecosystems.

The main factor influencing the microclimatic conditions in these communities is the presence of large amounts of living and/or dead plant mass, with the winter-cut stands in spring forming an exception. A thick layer of litter usually insulates thermally the deeper-situated bottom soil. This insulating effect is more pronounced in the terrestrial and limosal ecophases, when the litter is not flooded and is only partly saturated with water. The reduction of incoming radiation by a fully developed vegetative canopy usually makes the water cool in the reed belt in summer. These cool conditions reduce the rate of organic matter decomposition. In spring, the littoral microclimate appears to be relatively the most favorable of the whole fishpond. The increased water and bottom temperatures promote rapid plant growth. The microclimate within the canopies depends primarily on the ratio of dead to living plant material, which changes in the course of a year. (See also W80-01209) (Steiner-Mass)
W80-01218

RADIATION CLIMATE IN FISHPOND LITTORAL PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01219

WATER CHEMISTRY IN THE FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2K.
W80-01220

STRUCTURE AND CHEMISTRY OF THE FISHPOND BOTTOM,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2G.
W80-01221

INTRASPECIFIC AND CLONAL VARIABILITY AND ITS IMPORTANCE FOR PRODUCTION ESTIMATES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01222

SELECTION OF SAMPLING AREAS IN ASSESSMENT OF PRODUCTION,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 7B.
W80-01223

SEASONAL DEVELOPMENT OF HELOPHYTE POLYCORMONES AND RELATIONSHIP BETWEEN UNDERGROUND AND ABOVEGROUND ORGANS,
Ceskoslovenska Akademie Ved, Brno. Botanicka Ustav.
For primary bibliographic entry see Field 2I.
W80-01224

ESTIMATION OF SEASONAL GROWTH OF UNDERGROUND BIOMASS,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01226

GROWTH ANALYSIS OF FISHPOND LITTORAL COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01227

COMMUNITIES OF EMERGED FISHPOND SHORES AND BOTTOMS,
Ceskoslovenska Akademie Ved, Prague. Inst. of Entomology.
For primary bibliographic entry see Field 2I.
W80-01228

PRIMARY DATA ON BIOMASS AND PRODUCTION ESTIMATES IN TYPICAL STANDS OF FISHPOND LITTORAL PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01229

DETERMINATION OF ENERGY CONTENT AND NET EFFICIENCY OF SOLAR ENERGY CONVERSION BY FISHPOND HELOPHYTES,
Ceskoslovenska Akademie Ved, Trebon. Dept. Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01230

ESTIMATION OF NET PHOTOSYNTHETIC EFFICIENCY FROM GROWTH ANALYTICAL DATA,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01231

NET PHOTOSYNTHESIS AND DARK RESPIRATION OF REED ESTIMATED BY GAS-EXCHANGE MEASUREMENTS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I
W80-01232

MODELING OF PHOTOSYNTHETIC PRODUCTION IN LITTORAL HELOPHYTE STANDS,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany
For primary bibliographic entry see Field 2I.
W80-01233

WATER RELATIONS, WATER BALANCE, TRANSPORATION, AND WATER TURNOVER IN SELECTED REEDSWAMP COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01234

NUTRIENT UPTAKE BY LITTORAL COMMUNITIES OF HELOPHYTES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01235

GROWTH, PRODUCTION AND NUTRIENT UPTAKE OF DUCKWEEDS IN FISHPONDS AND IN EXPERIMENTAL CULTURES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01236

STRUCTURAL ELEMENTS. PRINCIPAL POPULATIONS OF ALGAE. SPATIAL DISTRIBUTION.
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01237

DYNAMICS OF ALGAL COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I
W80-01238

PRIMARY PRODUCTION AND FUNCTIONING OF ALGAE IN THE FISHPOND LITTORAL,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01239

DECOMPOSITION PROCESSES IN THE FISHPOND LITTORAL,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01240

MAMMALS IN THE REEDSWAMP ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
For primary bibliographic entry see Field 2I.
W80-01241

BIRDS IN THE REEDSWAMP ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
For primary bibliographic entry see Field 2I.
W80-01242

SOIL SURFACE ARTHROPODS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
For primary bibliographic entry see Field 2I.
W80-01243

INVERTEBRATES: DESTROYERS OF COMMON REED,
Ceskoslovenska Akademie Ved, Prague. Inst. of Entomology.
For primary bibliographic entry see Field 2I.
W80-01244

MACROFAUNA OF INVERTEBRATES IN HELOPHYTE COMMUNITIES,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
For primary bibliographic entry see Field 2I.
W80-01245

MANAGEMENT ASPECTS OF FISHPOND DRAINAGE,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
For primary bibliographic entry see Field 6G.
W80-01246

CONTROL OF REED AND REED MACE STANDS BY CUTTING,
Ceskoslovenska Akademie Ved. Prague. Botanicky Ustav.
For primary bibliographic entry see Field 2I.
W80-01247

ECOLOGICAL EFFECTS OF FISHPOND AMELIORATION,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
For primary bibliographic entry see Field 6G.
W80-01248

PROPAGATION, CULTIVATION AND EXPLOITATION OF COMMON REED IN CZECHOSLOVAKIA,
Ceskoslovenska Akademie Ved, Trebon. Inst. of Microbiology.
For primary bibliographic entry see Field 2I.
W80-01249

CONSERVATION OF PLANT COMMUNITIES IN FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
S. Hejny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 429-433, 1978. 1 Fig, 2 Tab.

Descriptors: *Freshwater marshes, *Conservation, *Czechoslovakia, Wetlands, Marshes, Marsh plants, Ponds, Littorals, Marsh management.

In Czechoslovak fishponds, the vegetation of aquatic vascular plants has been changing rapidly during the last twenty years because of the combined effects of intense fertilizing and manuring, duck-farming, and mechanical amelioration. The basically correct concept of rational control of macrophytes should therefore be replaced by a regulation of macrophyte development, combined with conservation. The conservation aspect is particularly important because the ponds still contain the largest pool of macrophyte species populations and communities in Central Europe--though somewhat altered. Most alluvial wetland habitats, by contrast, have been changed irreversibly or destroyed completely. (See also W80-01209) (Steiner-Mass)
W80-01250

CONSERVATION OF WILDFOWL IN FISHPOND REGIONS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
For primary bibliographic entry see Field 2I.
W80-01251

MODIFICATIONS TO THE MACKERETH CORER,
Australian National Univ., Canberra (Australia). Research School of Earth Sciences.
For primary bibliographic entry see Field 2J.
W80-01268

A CLOSE-INTERVAL WATER SAMPLER WITH MINIMAL DISTURBANCE PROPERTIES,
Oslo Univ. (Norway).
For primary bibliographic entry see Field 7B.
W80-01269

A DURABLE, RESUABLE ENCLOSURE SYSTEM THAT COMPENSATES FOR CHANGING WATER LEVELS,
Indiana Univ. at Bloomington. Dept. of Biology.
For primary bibliographic entry see Field 7B.
W80-01271

THE REMOVAL OF ORGANIC SURFACE FILMS BY RAIN,
Wisconsin Univ. Madison. Dept. of Civil and Environmental Engineering.
T. Green, and D. F. Houk.
Limnology and Oceanography, Vol 24, No 5, p 966-970, September 1979. OWRT B-060-WIS (2), 14-31-0001-3666.

Descriptors: *Monomolecular films, *Rain , *Organic compounds, Laboratory tests, Surface tension, Hexadecanol, Raindrops, Bubbles, Effects, Interfaces, Lakes, Film removal, Organic films.

Laboratory experiments suggested that natural rainfall can remove organic surface films from a water surface in minutes, or tens of minutes. The remove rate varies with raindrop size and seems to be associated with breaking bubbles, in turn due to the rain. (Sims-ISWS)
W80-01543

BIBLIOGRAPHY OF ENVIRONMENTAL STUDIES ON LAKE CHAMPLAIN,
Lake Champlain Basin Study, New England River Basins Commission, Burlington, Vermont; August, 1978. 53 p, Prepared by Paul R. Vachon.

Descriptors: *Bibliographies, *Lake Champlain, *Environment, Aquatic life, Aquatic plants, Benthos, Erosion, Flooding, Fisheries, Limnology, Planning, Resource development, Sedimentology, Water pollution, Water quality, Weather, Wetlands, Wildlife.

The bibliography lists and describes the nature of selected past and current environmental studies relevant to Lake Champlain and its drainage basin. Bibliographic categories include: aquatic life, aquatic plants, benthos, erosion, fisheries, flooding, limnology, planning, resource management, sedimentology, water pollution, water quality, weather, wetlands, and wildlife. (Steiner-Mass)
W80-01581

ENVIRONMENTAL FEATURES, GENERAL HYDROLOGY, AND EXTERNAL SOURCES OF NUTRIENTS AFFECTING WILDERNESS LAKE, KING COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
N. P. Dion.
Geological Survey Water-Resources Investigations 79-63 (open-file report), 1979. 27 p, 8 Fig, 3 Tab, 17 Ref.

Descriptors: *Lakes, *Hydrology, *Environmental effects, Hydrologic budget, *Eutrophication, Nutrients, Hydrogeology, Inflow, Discharge(Water), Septic tanks, Water quality, Washington, *Wilderness Lake(Wash), King County(Wash).

A water budget prepared for Wilderness Lake, a candidate for lake-quality restoration, indicates that of the 530 acre-feet of water that enters the lake each year, 170 acre-feet is from precipitation and 360 acre-feet is from groundwater inflow. An equal amount leaves the lake, and of this, 380 acre-feet is by surface runoff, 8 acre-feet is by groundwater seepage, and 140 acre-feet is by evaporation. Based on these amounts of inflow and outflow, the theoretical water-renewal time of the lake is calculated to be 2.6 years. The annual contributions of nitrogen and phosphorus to the lake from precipitation, natural ground water, and septic-tank leachate are about 920 kilograms nitrogen and 38 kilograms phosphorus. Nitrogen and phosphorus contributions from other sources were not assessed but could be significant. (Woodard-USGS)
W80-01595

2I. Water In Plants

POND LITTORAL ECOSYSTEMS
For primary bibliographic entry see Field 2H.
W80-01209

HIGHER PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved Botanicky Ustav.
S. Hejny, and S. Husak.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 23-64, 1978. 6 Fig, 3 Tab.

Descriptors: *Farm ponds, *Marsh plants, *Plant groupings, Wetlands, Lakes, Impounded waters, Survey, Aquatic plants, Biological communities, Distribution patterns, Census, *Czechoslovakia.

A survey is given of the vascular plant communities occurring in fishponds and in their littorals in the two regions studied within the Czechoslovak IBP Wetlands project; namely, in South Bohemia and South Moravia. Stress is laid on the general ecological characteristics of these communities classified into associations which are, in turn, grouped into foederations (alliances) as the nearest higher-ranking units according to the principles of the Zurich-Montpellier school of vegetation classification. (See also W80-01209) (Steiner-Mass)
W80-01212

ALGAL POPULATIONS RELATED TO DIFFERENT MACROPHYTE COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
P. Marvan, and J. Komarek.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 65-70, 1978. 1 Tab.

Descriptors: *Farm ponds, *Marsh plants, *Algae, Wetlands, Lakes, Sessile algae, Biological communities, Distribution patterns, *Czechoslovakia.

Characteristics and comparisons are given of the species composition in individual microphyte synusia associated with principle macrophyte communities. The basic data originate from the Opatovicky fishpond, Czechoslovakia, and are completed by further observations on the Nesyt fishpond, Czechoslovakia. (See also W80-01209) (Steiner-Mass)
W80-01213

AERIAL PHOTOGRAPHY AND MAPPING OF FISHPOND VEGETATION,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
P. Smid.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 71-73, 1978. 1 Fig.

Descriptors: *Farm ponds, *Marsh plants, *Aerial photography, Wetlands, Lakes, Distribution patterns, Succession, Mapping, Marsh management.

The mapping of the fishpond vegetation in the Czechoslovak IBP Wetland project served a two

fold purpose: (1) estimation of the areas covered by stands of different vegetation types, which might also serve as production types, and (2) documentation of different stages of development of the littoral vegetation and of its changes under various kinds of influence. The aerial photographs permit an examination of the long-term spreading of the stands, of their succession, as well as their seasonal development. (See also W80-01209) (Steiner-Mass)
W80-01214

ANIMAL POPULATIONS IN FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
J. Pelikan, K. Hudec, and K. Stastny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 74-79, 1978. 2 Fig, 2 Tab.

Descriptors: *Aquatic animals, *Farm ponds, Wetlands, Aquatic habitats, Wildlife habitat, Wildlife, Birds, Aquatic insects, Biological communities, *Czechoslovakia.

Rather varied biotypes frequently coexist in a fishpond and its surroundings. This is particularly true of large fishpond systems with their dams and interconnecting canals and ditches. The variety of biotopes is reflected in a corresponding variety of animal populations living together in a relatively small area but occupying different niches. A two-years' survey of the set of bird populations living on and along the dams fringing the flood plain of the ancient Nova Reka canal passing through a wooded and fishpond-rich part of the Trebon basi, Czechoslovakia, has detected altogether 60 species populations. (See also W80-01209) (Steiner-Mass)
W80-01215

DECOMPOSERS IN THE FISHPOND LITTORAL ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
B. Ulehlova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 80-87, 1978. 3 Fig, 5 Tab.

Descriptors: *Marsh plants, *Decomposing organic matter, *Aquatic microorganisms, Wetlands, Cattails, Littoral, Detritus, Deterioration.

Observations and experiments were performed to evaluate the numbers and composition of microflora associatted with different stages of decomposition of dead plant remnants, particularly those of Phragmites communis and Typha angustifolia. Standing dead Typha is much more densely colonized than standing dead Phragmites (on dry weight basis). Both kinds of dead material collected in aquatic habitats yield higher counts of microflora than those from terrestrial habitats. The differences between terrestrial and aquatic habitats are particularly pronounced in the case of Typha. Approximately one million microorganisms exist in one gram of dry standing dead material of littoral helophytes. The moisture of the standing dead material may differ considerably with habitat, which may control the counts of microorganisms. (See also W80-01209) (Steiner-Mass)
W80-01216

DEVELOPMENT OF WETLAND AND AQUATIC VEGETATION IN THE TREBON BASIN SINCE THE LATE GLACIAL PERIOD,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
V. Jankovska.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 88-92, 1978. 2 Fig.

Descriptors: *Marsh plants, *Geologic mapping, Wetlands, Peat, Palynology, Bogs, Stratification, Stratigraphy, Marshes, Swamps.

From the analyses of peatbog profiles, it was concluded that aquatic and wetland communities related to the present foederationes Potamion and Nymphaeion have been present in the Trebon basin since the late glacial period. Typha latifolia and Phragmites communis appeared probably during the Pre-boreal period and reedswamp communities developed fully during the Boreal period. Alder swamp forest has presumably been present since the Early Atlantic. (See also W80-01209) (Steiner-Mass)
W80-01217

RADIATION CLIMATE IN FISHPOND LITTORAL PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 113-125, 1978. 9 Fig, 4 Tab.

Descriptors: *Light, *Distribution patterns, *Marsh plants, Wetlands, Littoral, Radiation, Microclimatology, Microenvironment, Plant growth, Seasonal, Photosynthesis.

The penetration of radiation into a stand depends on a number of factors, among which stand geometry, canopy density, and wind conditions are the most important for the extinction of both direct and diffuse radiation. The flux of scattered radiation is mainly affected by optical properties of the leaves. Most of the stands examined such as Typha angustifolia, Typha latifolia, Acorus calamus, and Sparganium erectum, possess a more or less erectophile foliage, which enables the radiation to penetrate quite deep into their stands. Most of their young and physiologically active assimilatory tissues are located in the lower canopy layers and the deeply penetrating radiation is used for their photosynthesis. In Phragmites communis and Glyceria maxima, the youngest leaves are concentrated in the higher canopy layers. Their successive leaves grow on the stems and acquire, on the average, a near-horizontal position. (See also W80-01209) (Steiner-Mass)
W80-01219

INTRASPECIFIC AND CLONAL VARIABILITY AND ITS IMPORTANCE FOR PRODUCTION ESTIMATES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
D. Dykyjova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 159-163, 1978. 2 Fig, 1 Tab.

Descriptors: *Marsh plants, *Plant populations, *Variability, Wetlands, Freshwater marshes, Littoral, Productivity, Plant morphology, Genetics, Shape, Heterogeneity, Cattails.

Littoral stands of emergent macrophytes especially reed-bed stands, present relatively simple natural communities in which the population of the ecotype is the dominant component of the community. Phragmites communis is the most polymorphous and widespread species, growing uniform clonal populations in the variable littoral habitats. In its pure stands, it is possible to measure the variability of biomass production of one Phragmites clone, extended over an area within which there is large variation in edaphic and microclimatic conditions. Observations made so far seem to imply that the differences in the morphology of Phragmites from different regions could partly be explained on plant-geographical grounds. The other dominant reed-belt species appear to be as variable as the common reed. Typha angustifolia, displaying in many cases a very high production, inclines to hybridization with Typha latifolia. It is possible that some of the highly productive stands that were found, composed predominantly of sterile polycormones, were hybrids exhibiting a heterosis effect. (See also W80-01209) (Steiner-Mass)
W80-01222

SEASONAL DEVELOPMENT OF HELOPHYTE POLYCORMONES AND RELATIONSHIP BETWEEN UNDERGROUND AND ABOVEGROUND ORGANS,
Ceskoslovenska Akademie Ved, Brno. Botanicka Ustav.
K. Fiala.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 174-181, 1978. 6 Fig.

Descriptors: *Marsh plants, *Cattails, *Biomass, *Plant growth, *Root development, Wetlands, Freshwater marshes, Ponds, Littoral, Productivity, Standing crops, Seasonal, Rhizomes, Root systems.

The seasonal development of Typha polycormones may be approximately divided into four successive periods: (1) End of April to May: mobilization of reserve materials and development of the photosynthetic apparatus linked with a rapidly decreasing root-shoot ratio, (2) June: termination of, or a slow-down in the uptake of reserve substances from the rhizomes, continuing increase in aboveground biomass, appearance of the flowering shoots, the first off-shooting and growth of new underground organs; persistence in a marked decrease in the root/shoot ratio, (3) July to August: maximum development of the photosynthetic apparatus, formation of numerous offshoots, high increase in underground biomass; relative stabilization of the root-shoot ratio, (4) September to November: termination of the development of the photosynthetic apparatus, decrease in aboveground biomass, intense formation of offshoots and hibernating buds, accumulation of reserve substances in underground organs linked with an increase in the root/shoot ratio. (See also W80-01209) (Steiner-Mass)
W80-01224

EXPERIMENTAL HYDROPONIC CULTIVATION OF HELOPHYTES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany
D. Dykyjova, and K. Veber.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 181-192, 1978. 8 Fig, 2 Tab.

Descriptors: *Marsh plants, *Hydroponics, Wetlands, Plant growth, Cattails, Aquiculture, Marsh management, Cultivation, Freshwater marshes, Planting management, Vegetation establishment.

In experiments with different planting dates, outstanding symptoms of thermoperiodism and dormancy were found in all species investigated. All plants which developed from cuttings planted out in November were small as a result of an uncompleted bud-break period. This effect was more pronounced in the warmer greenhouse conditions and did not disappear even during the later spring. Typha latifolia shoots started from cuttings stored at low temperatures and planted out in January attained the same shoot height and density as those in natural stands. Phragmites plants started as one-year-old seedlings attained a high density during the spring months as well. Typha angustifolia requires a very high irradiance. It developed very slowly in the winter cultures as compared with the summer outdoor hydroponics, and produced only few lateral shoots even after termination of its bud break. Schoenoplectus lacustris and Acorus calamus developed better in a cooler environment, 13 to 15C, but they became easily etiolated at a low irradiance in warmer conditions. (See also W80-01209) (Steiner-Mass)
W80-01225

ESTIMATION OF SEASONAL GROWTH OF UNDERGROUND BIOMASS,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 193-197, 1978. 4 Fig, 1 Tab.

Descriptors: *Marsh plants, *Root systems, *Estimation, Wetlands, Leaves, Freshwater marshes, Standing crops, Marshes, Roots, Biomass, Plant growth.

Spring translocation can be estimated from the growth rate of leaf area and aboveground biomass. The time-lag of leaf growth of marsh plants controls the amount of material translocated from the reserves to the aerial organs; the ratio of the growth rate of leaf area to that of aboveground biomass determines the final ratio of underground to aboveground production. (See also W80-01209) (Steiner-Mass)
W80-01226

GROWTH ANALYSIS OF FISHPOND LITTORAL COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. Kvet.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 198-206, 1978. 6 Fig, 2 Tab.

Descriptors: *Marsh plants, *Plant growth, Wetlands, Ponds, Freshwater marshes, Littoral, Biological communities, Productivity, Cattails, *Czechoslovakia.

Growth analysis was used on the primary production of pond littoral vascular plants and their communities as a tool for evaluating the seasonal dynamics of their net production and vertical productive structure. The seasonal dynamics of aboveground net production were studied in almost monospecific stands formed by most of the dominants of the various associations belonging to the foederatio Phragmition communis. Growth analysis studies were also made in stands of pure Bolboschoenus maritimus and in Caricetum gracilis. The studies were undertaken in both South Bohemia and South Morovia (Czechoslovakia) fishpond and marshes. Growth analysis of complete polycormones of Typha angustifolia, Typha latifolia, and Phragmites communis were also performed. (See also W80-01209) (Steiner-Mass).
W80-01227

COMMUNITIES OF EMERGED FISHPOND SHORES AND BOTTOMS,
Ceskoslovenska Akademie Ved, Prague. Inst. of Entomology.
M. Rejmanek, and J. Velasquez.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 206-211, 1978. 2 Fig, 1 Tab.

Descriptors: *Ponds, *Biological communities, *Littoral, Wetlands, Marsh plants, Freshwater marshes, Plant growth, Growth stages, Emerging vegetation stage, *Czechoslovakia.

Communities of emerged fishpond shores and of summer-drained fishpond bottoms consist mostly of species populations or rapidly growing annual, biennial, or perennial plants with rather shallow root systems. The analysis of the growth and seasonal dynamics is thus relatively easy in these communities and their components. The depth of the nutrient-rich mud deposited on the bottom and soil moisture content represent the principal factors determining the growth and development of these populations. Two examples of growth analysis are given, one providing a comparison of growth dynamics in two communities colonizing different microhabitats in a summer-drained pond and the other showing the reaction of one monodominant community to the actual ecophase. (See also W80-01209) (Steiner-Mass)
W80-01228

PRIMARY DATA ON BIOMASS AND PRODUCTION ESTIMATES IN TYPICAL STANDS OF FISHPOND LITTORAL PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. Kvet, and S. Husak.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 211-216, 1978. 1 Fig, 2 Tab.

Descriptors: *Marsh plants, *Littoral, *Biomass, Wetlands, Ponds, Freshwater marshes, Density, Distribution patterns, Shores, Aquatic plants, Rooted aquatic plants.

The table presented, as well as other published data, confirms that in fishponds, as in other standing waters, the plant biomass increases, in general, from the hydrophyte and pleustophyte communities of the sublittoral, through the communities formed by rooted macrophytes of the hydroocthophyte and ochthohydrophyte life forms of helophytes which constitute the prevailing littoral to limosal zones of the reed-belt. Further landward, the plant biomass again decreases with increasing distance from the shoreline and/or the groundwater table. A pronounced gradient of biomass is also observed in the dominant helophyte synusium in any sufficiently broad reed belt. The biomass of the undergrowth synasium then depends, in the first place, on the canopy density of the dominant. (See also W80-01209) (Steiner-Mass)
W80-01229

DETERMINATION OF ENERGY CONTENT AND NET EFFICIENCY OF SOLAR ENERGY CONVERSION BY FISHPOND HELOPHYTES,
Ceskoslovenska Akademie Ved, Trebon. Dept. Hydrobotany.
D. Dykyjova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 216-220, 1978. 1 Fig, 2 Tab.

Descriptors: *Marsh plants, *Energy conversion, *Efficiencies, Wetlands, Ponds, Littoral, Energy, Photosynthesis, Energy budget, Light, Plant growth.

The energy content is highest in young shoots in spring and decreases during the growing season. Fruits, flowers, and inflorescences have a higher energy content than either the vegetative aboveground parts or underground storage organs. The latter contain mainly glycids. The decrease in energy content with the aging of vegetative plant organs corresponds to other authors' data. It also reflects the seasonal decrease in the contents of energy-rich substances such as proteins, phosphatids, and other lipids, and the increase in the contents of energy-poor cell-wall materials such as cellulose, pectins, or lignin. The net conversion efficiency of solar energy calculated for a whole growing season is positively correlated with the seasonal maximum of biomass and negatively with the number of days of the growing season involved in the calculation. The shorter the growing season and the smaller the sum of incident radiation, the higher the coefficient of energy conversion. Several estimates of the coefficient for shorter time intervals during the growing season are thus of greater value. (See also W80-01209) (Steiner-Mass)
W80-01230

ESTIMATION OF NET PHOTOSYNTHETIC EFFICIENCY FROM GROWTH ANALYTICAL DATA,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 221-227, 1978. 5 Fig, 2 Tab.

Descriptors: *Marsh plants, *Energy conversion, Wetlands, Cattails, Photosynthesis, Primary productivity, Plant growth, Efficiencies, Energy, Littoral.

Data on the seasonal increments in underground organs were obtained for Typha angustifolia and Typha latifolia and used for calculating the seasonal changes in the net assimilation rate (NAR). The NAR is quite high, with somewhat higher values in Typha angustifolia than in Typha latifolia. The high net photosynthetic efficiency of these species contributes to the explanation of the high productivity. As the net assimilation leaf efficiency (NALE) could not be evaluated, it could not be decided whether this high productivity is to be attributed to a highly favorable radiation regime in the Typha polycormones or to a high photosynthetic rate of their leaf tissues. NALE was calculated for a Phragmites stand and was determined not to exceed the value of 3.0 g/MJ. (See also W80-01209) (Steiner-Mass).
W80-01231

NET PHOTOSYNTHESIS AND DARK RESPIRATION OF REED ESTIMATED BY GAS-EXCHANGE MEASUREMENTS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
J. Gloser.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 227-234, 1978. 7 Fig, 2 Tab.

Descriptors: *Marsh plants, *Respiration, *Photosynthesis, Wetlands, Freshwater marshes, Primary productivity, Plant physiology, Carbon cycle, Carbon dioxide, Leaves.

Gasometric measurements of net photosynthesis and dark respiration were performed with the aim of assessing some basic data necessary for mathematical modeling of canopy photosynthesis and primary production in Phragmites communis stands. The net photosynthetic and dark respiration rates were calculated from the values of CO2 uptake and output. The CO2 exchange characteristics were related to both leaf area and leaf weight as well as to individual leaf laminae. Photosynthetic activity was very little affected by leaf aging. The dark respiration rate per unit leaf area decreases from the youngest to the basal leaves, but in very old leaves, exceptionally high rates were detected in some instances. The inflorescences are characterized by low rates of net photosynthesis and by high rates of dark respiration. The CO2 concentration was never markedly less within the leaf canopy than was the above-canopy concentration. The CO2 depletion in the Phragmites stand caused by its photosynthetic activity is probably very small and unimportant in limiting the canopy photosynthesis. (See also W80-01209) (Steiner-Mass)
W80-01232

MODELING OF PHOTOSYNTHETIC PRODUCTION IN LITTORAL HELOPHYTE STANDS,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok, and J. Gloser.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 234-245, 1978. 10 Fig, 2 Tab.

Descriptors: *Marsh plants, *Model studies, *Photosynthesis, *Carbon dioxide, Wetlands, Freshwater marshes, Primary productivity, Respiration, Plant physiology, Carbon cycles, Littoral.

A model of CO2 uptake and dark respiration was derived for a pure stand of Phragmites communis. The model has empirical character in some points and mimics the principal functions of a photosynthetic system and their dependence on various factors. Stress is laid upon a detailed elaboration of the radiation interception regime which determines the input into the system. Several simplifications have been made in the first version of the model with respect to the importance of individual factors influencing photosynthesis. The model can be used to estimate the seasonal course of CO2 assimilation in the leaves and dark respiration in both leaves and stems and their seasonal totals. Another application of the model is the study of stand photosynthetic activity under various conditions simulated by enhancing parameters of the model. (See also W80-01209) (Steiner-Mass)
W80-01233

WATER RELATIONS, WATER BALANCE, TRANSPORATION, AND WATER TURNOVER IN SELECTED REEDSWAMP COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
M. Rychnovska.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 246-256, 1978. 3 Fig, 6 Tab.

Descriptors: *Marsh plants, *Transpiration, *Water balance, Wetlands, Freshwater marshes, Water loss, Littoral, Water storage, Plant physiology, Turnovers.

Mature shoots of Phragmites communis show considerable fluctuations in their water content expressed in terms of percentage dry weight. The variation in water content in whole shoots from populations in different biotopes is considerable. Plants from a stand at littoral ecophase and hence well-supplied with water mostly show a slightly lower water content than terrestrial stands. A considerable water saturation deficit can be determined in all Phragmites populations, regardless of whether they grow in water or on dry land. The transpiration rates (water loss per minute) are lower in all terrestrial stands than those found in littoral shoots. Because of rapid evaporation of the

morning dew, the period of transpiration during the day is, however, longer in the terrestrial Phragmites patch. The daily water output is thus much the same for both populations. (See also W80-01209) (Steiner-Mass)
W80-01234

NUTRIENT UPTAKE BY LITTORAL COMMUNITIES OF HELOPHYTES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
D. Dykyjova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 257-277, 1978. 13 Fig, 7 Tab.

Descriptors: *Marsh plants, *Nutrient requirements, *Productivity, Wetlands, Freshwater marshes, Littoral, Ponds, Nutrients, Plant physiology, Fertilizers, Nutrient removal, Calcium, Phosphorus.

In order to examine the relations between the nutrient availability and net production in helophyte communities in fishpond littorals, chemical analyses were made in their water, supropels, bottom soils, and plant biomass. To compare the chemistry in different habitats, only monocenotic communities were analyzed. The young and photosynthetically highly active leaves or shoots contain higher percentages of mineral nutrients than the stems. Some nutrients, such as P and Mg, become accumulated in panicles or fruits. Underground storage organs accumulate energy-rich organic matter, but relatively less of mineral elements. Calcium, entering the plants mainly passively with the transpiration stream, accumulates in the leaves in the form of insoluble compounds, and its content progressively increases with the aging of the leaf tissues. The helophyte species vary in their selective absorption capacity. Some species such as Sparganium erectum, Acorus calamus, and Glyceria maxima are highly plastic in their nutrient uptake and absorb high amounts of nutrients from the fertile sapropels. (See also W80-01209) (Steiner-Mass)
W80-01235

GROWTH, PRODUCTION AND NUTRIENT UPTAKE OF DUCKWEEDS IN FISHPONDS AND IN EXPERIMENTAL CULTURES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
E. Rejmankova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 278-284, 1978. 6 Fig, 3 Tab.

Descriptors: *Plant growth, *Floating plants, *Marsh plants, Wetlands, Littoral, Ponds, Aquatic plants, Pondweeds, Productivity, Biomass.

The production of duckweeds was assessed in the littoral of the large Nesyt and Opatovicky fishponds, Czechoslovakia, in four small heavily eutrophicated village ponds in South Bohemia, and in outdoor hydroponic cultures. In the fishponds, the duckweed biomass was smallest in dense stands of both Phragmites communis and Typha angustifolia; duckweeds covered about a quarter of the water surface in these stands. The growth of duckweeds is limited there by very low irradiance at water levels. The differences in the relative growth rate of duckweeds in different helophyte stands are in agreement with the data on biomass. The growth of duckweed populations is negatively density-dependent after they have attained a 100% cover. In the hydroponic cultures it was found that the relative growth rate roughly follows the course of both the water temperature and the incoming solar radiation. (See also W80-01209) (Steiner-Mass)
W80-01236

STRUCTURAL ELEMENTS. PRINCIPAL POPULATIONS OF ALGAE. SPATIAL DISTRIBUTION.
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
P. Marvan, J. Komarek, H. Ettl, and J. Komarkova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 295-313, 1978. 4 Fig, 7 Tab.

Descriptors: *Ponds, *Aquatic populations, *Aquatic algae, Littoral, Spatial distribution, Plant populations, Aquatic plants, Aquatic microorganisms, Census, Scum, Cyanophyta, Plankton, Diatoms.

A comparison was made of the algal flora in two fishponds, Opatovicky in South Bohemia and Neyst in South Morovia (Czechoslovakia). Both ponds were similarly managed and highly eutrophic. In Opatovicky, the most important elements are planktonic algae present in both the pelagial and the reed-belt for most of the year, with dominant chlorococcal and/or blue-green algae. In Neyst, the number of planktonic algal species is much the same, but many species occur solely in the eutrophicated western bay enriched with phytoplankton from the principal inflow. This is rich in chlorococcal algae, centric diatoms, and in flagellates belonging to different taxonomic groups. Filamentous green algae, however, take up a prominent position in Neyst, being the most productive component of the littoral algal vegetation. Their communities comprise relatively few dominants capable of rapid growth and reproduction under favorable conditions. (See also W80-01209) (Steiner-Mass)
W80-01237

DYNAMICS OF ALGAL COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
P. Marvan, J. Komarek, H. Ettl, and J. Komarkova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 314-320, 1978. 2 Fig.

Descriptors: *Aquatic algae, *Plankton, *Dynamics, Wetlands, Ponds, Marsh plants, Aquatic populations, Aquatic microorganisms, Plant populations, Marsh management, Littoral.

Plankton elements take up an important position in many types of littoral macrophyte communities in most fishponds. The dynamics of their development appear to be influenced not only by changes in the physical, chemical, and biotic factors in the littoral community, but also by those in the pelagial and by the intensity of water exchange between the two zones. The course of changes in the composition of phytoplankton may be altered by fishpond management. (See also W80- 01209) (Steiner-Mass)
W80-01238

PRIMARY PRODUCTION AND FUNCTIONING OF ALGAE IN THE FISHPOND LITTORAL,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. Komarkova, and P. Marvan.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 321-334, 1978. 5 Fig, 8 Tab.

Descriptors: *Aquatic life, *Littoral, *Primary productivity, Wetlands, Ponds, Plankton, Aquatic plants, Phytoplankton, Periphyton, Fish management.

In all instances, the helophyte production in the littoral surpasses considerably that of the phytoplankton. As the phytoplankton represents the most important source supporting the trophic steps leading to fish production, and the phytoplankton development is controlled by the density of the helophyte communities, an excessively wide shallow littoral zone is regarded as undesirable in intensely managed fishponds. If the total primary production by algae in a whole managed fishpond is considered from this aspect, the participation of the littoral in aquatic primary production is relatively small in comparison with the production in the open water. These data contradict those from several lakes inferring that the littoral zone is more productive and its phytoplankton and periphyton play an important part in the primary production of the whole lake. (See also W80-01209) (Steiner-Mass)
W80-01239

DECOMPOSITION PROCESSES IN THE FISHPOND LITTORAL,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
B. Ulehlova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 341-353, 1978. 5 Fig, 6 Tab, 27 Ref.

Descriptors: *Littoral, *Marsh plants, *Decomposing organic matter, Wetlands, Detritus, Ponds, Nitrogen, Carbon, Deterioration, Rates, Temperature.

Definite temporal and spatial patterns characterize the decomposition rate of organic materials. The decomposition rate depends on the quality of the plant material and on the time of exposure. The rate decreases with advanced decomposition. The temperature, moisture content, and aeration are the determinants in the decomposition process. The half-time of decomposition of plant remnants varies from 4 to 12 months, according to the kind of plant material. During the decomposition of plant remnants, their carbon content decreases concurrently with the loss in weight. In winter, the loss of carbon and phosphorus from the decomposing plant material proceeds at a higher rate than in summer, reflecting changes in predominance of either mineralization or humification. Nitrogen content usually increases in the decomposing plant material. The increase in nitrogen content is greater than that expected from carbon loss, pointing to an active accumulation of nitrogen. (See also W80-01209) (Steiner-Mass)
W80-01240

MAMMALS IN THE REEDSWAMP ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
J. Pelikan.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 366-372, 1978. 2 Fig, 1 Tab.

Descriptors: *Wetlands, *Mammals, *Productivity, Aquatic animals, Wildlife habitats , Rodents, Wildlife, Distribution, Freshwater marshes, *Czechoslovakia.

Investigations of the secondary productivity and the function of mammals in wetlands of Czechoslovakia were carried out to discover the species diversity, the ecological dominance of species in successive trophic levels, and the energy flow and role of the mammalian populations in the wetland ecosystems. The research was carried out in the South Moravian lowlands. Particular attention was paid to the water role (Arvicola terrestris) with respect to its negative effects on gardens and orchards. (See also W80-01209) (Steiner-Mass)
W80-01241

BIRDS IN THE REEDSWAMP ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
K. Hudec, and K. Stastny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 366-372, 1978. 2 Fig, 1 Tab.

Descriptors: *Freshwater marshes, *Birds, Wetlands, Distribution patterns, Water birds, Wildlife, Wildlife habitats, Broods, Nests, Census, Animal populations, Productivity, *Czechoslovakia.

Investigations were made on the secondary production and role of birds in the reedswamp ecosystems in Czechoslovakia. Data was obtained on the species composition and numbers of birds breeding in various types of reedswamps, on the basic parameters of population dynamics, and on the impact of the dominant bird species on the reedswamp vegetation. The investigations were carried out in the regions, in South Moravia and South Bohemia. (See also W80-01209) (Steiner-Mass)
W80-01242

SOIL SURFACE ARTHROPODS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
R. Obrtel.

In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 373-375, 1978.

Descriptors: *Freshwater marshes, *Insects, Wetlands, Aquatic animals, Diptera, Mites, Census.

Material of surface-active arthropods was obtained in the terrestrial ecophase of a Czechoslovak reeds-wamp. The material consisted of isopods, spiders, mites, harvestmen, and insects, both at their adult and developmental stages. Of the insects the material comprised springtails, beetles, various forms of dipterous insects, aphids, leafhoppers, and various forms of hymenopterous insects. (See also W80-01209)
W80-01243

INVERTEBRATES: DESTROYERS OF COMMON REED,
Ceskoslovenska Akademie Ved, Prague. Inst. of Entomology.
V. Skuhravy.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 376-388, 1978. 9 Fig, 1 Tab.

Descriptors: *Marsh plants, *Invertebrates, *Plant growth, Wetlands, Freshwater marshes, Insects, Insect behavior, Damages, *Czechoslovakia.

Attention was focused on specie s causing damage to common reed and depleting its reproductive rate. According to the type of injury, the foll owing breakdown was made: (1) Species damaging the growing point of the reed (with or without gall formation) and checking the growth of reed stems, (2) species developing inside the stems and causing them to break, (3) species causing lateral damage by attacking lateral shoots, and (4) species living on the leaves. (See also W80-01209) (Steiner-Mass)
W80-01244

MACROFAUNA OF INVERTEBRATES IN HELOPHYTE COMMUNITIES,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
J. Dvorak.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 389-392, 1978. 1 Tab.

Descriptors: *Freshwater marshes, *Invertebrates, *Aquatic animals, Wetlands, Distribution patterns, Littoral, Marsh plants, Biomass, *Czechoslovakia.

Both the quality and quantity of the macrofauna are subject to marked seasonal changes in each habitat followed. This seasonal succession reflects the pattern of life cycles and migration of the populations constituting the respective animal communities. Gradients from the shoreline to open water pertain not only to the environmental factors but also to the quantitative structure and dynamics of the animal communities. Such gradients develop even within one helophyte community type, particularly in Glycerietum maximae. The animal communities seem to constitute themselves in relation to a whole complex of ecological factors, without specific bonds to any particular plant community type. More pronounced effects of the vegetation cover have only been observed in communities dominated by Carex spp., Equisetum limosum, and Phragmites, while Glceria maxima and Sparganium erectum have little effect on the animal communities. (See also W80-01209) (Steiner-Mass)
W80-01245

CONTROL OF REED AND REED MACE STANDS BY CUTTING,
Ceskoslovenska Akademie Ved. Prague. Botanicky Ustav.
S. Husak.
In Pond: Littoral Ecosystems, Springer-Verlag, New York, p 404-408, 1978. 2 Fig, 1 Tab.

Descriptors: *Marsh plants, *Cutting management, *Cattails, Wetlands, Freshwater marshes, Marsh management, Vegetation regrowth, Plant growth.

Investigations were aimed at assessing the response of Typha angustifolia and Phragmites communis to the prevention of flowering and to varying degrees of control by cutting. The species reacted to the destructive control very differently. Typha was quicker both to react and to regenerate after cutting. In Phragmites, the cut induced an increase in stand de nsity and homogeneity. The cut was applied to the Phragmites stand somewhat late to induce any drastic changes in its performance. A more pronounced response would have been induced if the treatment had been supplied earlier; best in early June, at the time of lowest reserve content in the rhizomes but immediately before the onset of panicle emergence at the latest. (See also W80-01209) (Steiner-Mass)
W80-01247

PROPAGATION, CULTIVATION AND EXPLOITATION OF COMMON REED IN CZECHOSLOVAKIA,
Ceskoslovenska Akademie Ved, Trebon. Inst. of Microbiology.
K. Veber.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 416-423, 1978. 4 Fig, 3 Tab.

Descriptors: *Marsh plants, *Marsh management, *Cultivation, Wetlands, Freshwater marshes, Vegetation establishment, Planting management, Cutting management, Value, Crop production, Productivity, *Czechoslovakia.

In Czechoslovakia, the demand for reed products exceeds their production because the supply of high-quality reed culms is insufficient. Efforts are being made to increase reed production by effectively exploiting the existing reed sources as well as by establishing new reed beds. A survey is given of methods of reed propagation, cultivation, and introduction required to achieve this aim. The present state of commercial reed production in Czechoslovakia is also reviewed. (See also W80-01209) (Steiner-Mass)
W80-01249

CONSERVATION OF PLANT COMMUNITIES IN FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
For primary bibliographic entry see Field 2H.
W80-01250

CONSERVATION OF WILDFOWL IN FISHPOND REGIONS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
K. Hudec, and K. Stastny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 434-437, 1978.

Descriptors: *Wildlife, *Conservation, *Freshwater marshes, Wetlands, Ponds, Littoral, Marshes, Marsh management, Wildlife habitats, Birds, *Czechoslovakia.

Conserving large areas covered with reed is of importance for the occurrence of certain species of birds; namely, the large and typically reed-inhabiting ones. For a numerous occurence of the major species, rather narrow reed-belts of sufficient lengths are satisfactory. A very narrow belt of pure reed, less than about 10 m in width, is satisfactory for just a small number of species. The areas adjacent to the reed stands on the shore are very important for some of the reed-inhabiting species of birds. It is particularly advantageous if the reed stands pass gradually into permanent low waterlogged vegetation, at least on a minor part of the whole area. Presence of water in stands is essential. (See also W80-01209) (Steiner-Mass)
W80-01251

DETERMINISTIC HYDROLOGIC MODELING OF GRAZING SYSTEM IMPACTS ON INFILTRATION RATES,
Utah State Univ., Logan. Watershed Science Unit.
For primary bibliographic entry see Field 2G.
W80-01544

BIBLIOGRAPHY OF ENVIRONMENTAL STUDIES ON LAKE CHAMPLAIN,
For primary bibliographic entry see Field 2H.
W80-01581

2J. Erosion and Sedimentation

MODIFICATIONS TO THE MACKERETH CORER,
Australian National Univ., Canberra (Australia). Research School of Earth Sciences.
C. E. Barton, and F. R. Burden.
Limnology and Oceanography, Vol 24, No 5, p 977-983, September 1979. 3 Fig, 1 Tab, 2 Ref.

Descriptors: *Core drilling, *Equipment, *Lake sediments, Cores, Sediments, Lakes, Instrumentation, Design, Sampling, Paleoclimatology, Paleolimnology, Limnology, Sedimentology, Sediment corers, Paleomagnet.

The 6-m Mackereth corer has proved excellent for many aspects of Quaternary research, particularly in the growing field of paleomagnetic work on lake sediments. A 12-m version of the corer was described together with a magnetic orientation system. (Sims-ISWS)
W80-01268

RESUME OF RESEARCH INTO RIVER CHANNEL CHANGES CONDUCTED IN THE USSR,
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
V. V. Kuprianov, and Z. D. Kopaliani.
Hydrological Sciences Bulletin, Vol 24, No 3, p 345-349, September 1979. 1 Fig, 11 Ref.

Descriptors: *Channel morphology, *Rivers, *Erosion, *Sedimentation, Sediments, Sediment transport, Deposition(Sediments), Meanders, Islands, Channels, Streamflow, Soil mechanics, Geomorphology, Hydrodynamics, Hydrology, *USSR.

This paper described briefly some findings and investigations on the problem of channel processes conducted in the USSR. The development of the general theory of channel processes is far from complete. The present stage in the development of the hydromorphological trend shows the tendency for deeper quantitative analyses of the channel processes and for the improvement of quantitative methods for the computation and forecasting of the channel changes. Taking into account the complicated nature of the given problem and its importance all over the world, it seems expedient to exchange ideas, information, research experience, and results obtained by scientists representing various schools of different countries. (Sims-ISWS)
W80-01274

RADIOCARBON DATING OF A CORE FROM LONG ISLAND SOUND,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
G. J. Benoit, K. K. Turekian, and L. K. Benninger.
Estuarine and Coastal Marine Science, Vol 9, No 2, p 171-180, August 1979. 1 Fig, 2 Tab, 26 Ref. DOE EY-76 S-02-3573.

Descriptors: *Radioactive dating, *Carbon radioisotopes, *Sedimentation rates, Sediments, Cores, Sampling, Carbon, Organic matter, Analytical techniques, Chemical analysis, Measurement, Mathematical models, Coasts, Estuaries, *Long Island Sound, *Connecticut coast.

Radiocarbon measurements sequentially with depth in a diver-obtained core from Long Island Sound were interpreted in terms of sediment accumulation rates and sources of organic carbon in the sediment. A sediment accumulation rate of 0.075 plus or minus 0.013 cm/year was determined from the data below 10 cm in the core. An age of 2320 year BP was obtained for the sediment-water interface by extrapolation. This means that the dominant carbon component preserved in the core was soil-derived. The contributions of fossil fuel carbon and bomb radiocarbon associated with plankton were also evaluated. (Sims-ISWS)
W80-01289

NOTES ON SEDIMENTATION ACTIVITIES CALENDAR YEAR 1976,
Water Resources Council, Washington, Sedimentation Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 542, Price codes: A11 in paper copy, A01 in microfiche. September 1977. 242 p, 16 Ref, 1 Append.

Descriptors: *Sedimentation, *Research and development, *Projects, Research facilities, Federal government, Sediment transport, Suspended solids, Erosion, Sedimentation rates, Sediments, Sedimentology, Reviews.

This report was a digest of information furnished by Federal agencies conducting sedimentation investigations on work in progress or planned, important fundings, new methods, new publications, laboratory and other research activities, and other pertinent information. The material was organized by major drainage regions in the conterminous United States, Alaska, Hawaii, Puerto Rico, and foreign. There was also a section on research and other activities. Appendix A listed agency addresses by departments where information on agency activities can be obtained. (See also W78-01185 and W78-05057) (Froehlich-ISWS)
W80-01294

VARIATION OF ALLUVIAL-CHANNEL WIDTH WITH DISCHARGE AND CHARACTER OF SEDIMENT,
Geological Survey, Lawrence, KS. Water Resources Div.
W. R. Osterkamp.
Geological Survey Water-Resources Investigations 79-15, June 1979. 11 p, 4 Fig, 9 Ref.

Descriptors: *Alluvial channels, *Flow characteristics, *Channel morphology, *Effects, *Sedimentation, Bottom sediments, Bank stability, Width, Perennial streams, Data collections, Analytical techniques, Evaluation, *Channel width-discharge relationship, Fixed exponent.

Use of channel measurements to estimate discharge characteristics of ungaged streams has shown that little agreement exists for the slope of the width-discharge regression relation. Three groups of perennial stream channels with differing characteristics were selected for study using consistent procedures of width measurement. A common feature of the groups was general channel stability, that is, absence of excessive widening by recent extremely high discharges. The groups were: (1) 32 channels of gradient exceeding 0.0080, low suspended-sediment discharge, high channel roughness, and low discharge variability; (2) 13 streams of similar climatic conditions and having at least 70 percent silt and clay in the bed material; and (3) 18 spring-discharge channels with steady discharge and similar climate. Values for the exponent for the three groups are 1.98, 1.97, and 1.97, respectively; coefficient values are 0.017, 0.042, and 0.011 (when using metric units). Assuming a constant exponent of 2.0, equations were developed expressing the manner in which channel sediment affects the width-discharge relation. (Woodard-USGS)
W80-01426

NOTES ON SEDIMENTATION ACTIVITIES, CALENDAR YEAR 1977,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-01593

2K. Chemical Processes

IMPACT OF WATER AND SOILS HAVING HIGH SOURCE-SINK POTENTIALS ON WATER AND SALINITY MANAGEMENT UNDER IRRIGATION IN THE UPPER COLORADO RIVER BASIN.
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
L. S. Williardson, R. Hanks, and J. Jurinak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111727 Price Codes: A06 in paper copy, A01 in microfiche. Utah Water Research Laboratory, Utah State University, Water Resources Planning Series P-79/06, July 1979, 101 p, 74 Fig, 10 Tab, 6 Append, OWRT-B-148-UTAH (1), 14-34-0001-7195.

Descriptors: *Saline soils, *Irrigation water, *Cation exchange, *Sinks, Water chemistry, Salinity, Leaching, Return flow, Water quality, Irrigation, *Ashley Valley(UT), *Water management model.

A soil solution chemistry model was developed to describe the soil-irrigation water interactions. The model includes the effect of cation exchange capacity. The model was calibrated and checked with data obtained from lysimeters. A water management model that contained a soil solution chemistry component was calibrated for the Ashley Valley of Utah and was used to determine the sensitivity of stream flows and salinity to irrigation water management alternatives. The source-sink behavior of soils was found to depend on water quality, residual soil salinity, and water management practices. The key relationships are described. In applying these relationships, site specific conditions must be examined to determine the effectiveness of proposed irrigation management changes that are expected to affect downstreams salinity.
W80-01208

WATER CHEMISTRY IN THE FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
B. Ulehlova, and S. Pribil.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 126-140, 1978. 14 Fig, 4 Tab.

Descriptors: *Water chemistry, Temporal distribution, *Littoral, Wetlands, Farm ponds, Phosphorus, Nitrates, Mineralogy, Ammonia.

Certain cations and anions show typical patterns of seasonal variations despite differences in pond management. Nitrates and ammonia are relatively high in early spring and low during the rest of the year. Potassium, bicarbonate, and phosphate tend to increase more or less steadily from spring to fall. Two main peaks of phosphorus appeared on the curves for water samples from different sites, one in late May to early June, and the other in late July to early August. In these periods, phosphate phosphorus was intensely released either from dying-off biotic populations or from decaying organic materials. (See also W80-01209) (Steiner-Mass)
W80-01220

CHARACTERIZATION OF THE PH BUFFERING SYSTEMS IN DILUTE ADIRONDACK SURFACE WATERS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
J. J. Bisogni, Jr., and C. T. Driscoll, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113426, Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report, October, 1979. 134 p, 44 Fig, 23 Tab, 45 Ref, 15 Append. OWRT A-073-NY (1), 4-34-0001-7068 and 8034.

Descriptors: *Water chemistry, *Hydrogen ion concentrations, *Lakes, *Streams, Aluminum, Hydrogen, Acid precipitation, Buffer capacity, Adirondak Region (NY).

This research project investigated the aquatic chemistry of some dilute surface waters in the Adirondack Region of New York State. Particular emphasis was placed on characterizing the pH buffering systems in lakes and streams that have experienced acid precipitation. Eighteen water quality parameters were monitored for a period of one year at three lakes and their tributaries . Lake sediment analyses were also performed. Analytical methods were developed to estimate speciation of aluminum and to estimate the components of acid neutralizing capacity. The results of this study indicate that acid cations, hydrogen and aluminum, play a significant role in the overall aqueous chemistry of the surface waters studied. Natural organic acids and inorganic aluminum are very important pH buffering components in these waters.
W80-01257

IMPACT OF WESTERN COAL MINING--I. CHEMICAL INVESTIGATIONS OF A SURFACE COAL MINE SEDIMENTATION POND,
Montana State Univ., Bozeman. Dept. of Microbiology.
S. C. Turbak, G. J. Olson, and G. A. McFeters.
Water Research, Vol 13, No 11, p 1023-1031, 1979. 3 Fig, 1 Tab, 35 Ref.

Descriptors: *Coal mines, *Strip mines, *Mine water, *Montana, Water chemistry, Chemicals, Sodium, Sulfates, Bicarbonat es, Nitrogen, Dissolved oxygen, Ions, Cautions, Anions, Mercury, Hydrogen ion concentration, Sampling, Chemical analysis, Ponds.

Chemical investigations of the sedimentation pond system at the West Decker Mine in southeastern Montana were undertaken during an 18 month period from November 1975 to April 1977. Sedimentation pond water, essentially 'altered' groundwater, differed chemically from the average groundwater in coal-bearing aquifers. The increase in certain chemical constituents (sodium, sulfate, bicarbonate and inorganic nitrogen) and the decrease in dissolved oxygen in pond water during autumn 1976 and winter 1977 were the results of erratic pond operation, dreging, and increased nearby mining activity. Discharge from the pond complied with the guidelines advanced for effluents from surface coal mines. Levels of mercury in water samples collected from the sedimentation pond system were higher than those recommended for the protection of aquatic life and wildlife. The suitability of pond water for selected purposes and recommendations for improvement in pond design were discussed. (Sims-ISWS)
W80-01285

CHLORINE, BROMINE AND IODINE IN MONSOON RAINS IN INDIA,
Bhabha Atomic Research Centre, Bombay (India). Air Monitoring Section.
S. Sadasivan, and S. J. S. Anand.
Tellus, Vol 31, No 3, p 290-294, August 1979. 3 Tab, 3 Ref.

Descriptors: *Chemistry of precipitation, *Monsoons, *Rain, *Halogens, Sampling, Chemical analysis, Rainfall, Sea water, Chlorine, Bromine, Iodine, Sodium, Rain water, Analytical techniques, Precipitation(Atmospheric), *India.

The mean concentrations of the halogens chlorine, bromine, and iodine in a large number of rainwater samples collected in India during the south-west monsoon at the west coast and at two sites on the hill range near the west coast were presented and discussed. The concentration and ratios of these halogens in the rainwater samples compared very well with those previously observed in marine precipitations. There was no change in the Cl/Na ratios with collection altitude. Br showed a slight enrichment relative to Na at most of the sampling locations and a nominal depletion at one of the sites on the hills. Iodine enrichment was high at all sampling sites, and the samples from the higher altitude station on the hills showed the maximum enrichment. The study confirmed that large deposition of sea salt occurs along the west coast of India due to the monsoonal flow. (Sims-ISWS)
W80-01291

CHEMICAL QUALITY OF GROUND WATER IN THE EASTERN SACRAMENTO VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. P. Fogelman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 241, Price codes: A04 in paper copy, A01 in microfiche
Geological Survey Water-Resources Investigations

78-124, June 1979. 45 p, 10 Fig, 10 Tab, 28 Ref.

Descriptors: *Water quality, *Groundwater, *Chemical analysis, *Water wells, *Water types, Biocarbonates, Water utilization, Crop response, Irrigation, Agriculture, Domestic water, Water analysis, Drawdown, Pumping, Evaluation, Water chemistry, California, *Eastern Sacramento Valley(CA).

The study area is about 1,300 square miles in the eastern Sacramento Valley, Calif., extending from the latitude of Roseville on the south to thelatitude of Chico on the north. Considering the increased agricultural development of the area, this report documents the chemical character of the ground water prior to water-level declines that could result from extensive pumping for irrigation or to changes caused by extensive use of imported surface water. Chemical analyses of samples from 222 wells show that most of the area is underlain by ground water of a quality suitable for most agricultural and domestic purposes. Ninety-five percent of the water sampled has dissolved-solids concentrations of less than 700 milligrams per liter. The general water type for the area is a calcium and magnesium bicarbonate water and there are negligible amounts of toxic trace elements. The potential for water-quality problems exists in the area south of Yuba City along the west bank of the Feather River. There, concentrations of chloride, sulfate, and dissolved solids are higher than in other parts of the area, and they could limit future agricultural activities if chloride- and sulfate-sensitive crops are grown. (Woodard-USGS)
W80-01425

2L. Estuaries

ALKALINITY AND PH IN THE SOUTHERN CHESAPEAKE BAY AND THE JAMES RIVER ESTUARY,
Old Dominion Univ., Norfolk, VA. Inst. of Oceanography.
G. T. F. Wong.
Limnology and Oceanography, Vol 24, No 5, p 970-977, September 1979. 6 Fig, 2 Tab, 18 Ref.

Descriptors: *Alkalinity, *Hydrogen ion concentration, *Chesapeake Bay, *Estuaries, On-site investigation, On-site data collections, Sampling, Surveys, Data processing, Regression analysis, Chemicals, Water chemistry, Salinity, Coasts, Water circulation, *James River(VA), Carbonic acid.

The ranges of alkalinity and pH in the southern Chesapeake Bay and the James River estuary were 2.25 meq/liter at 32 parts per thousand to less than 0.85 at salinities below 6 parts per thousand and 7.5-8.3 during the sampling period. Alkalinity was linearly related to salinity in southern Chesapeake Bay. In the James River estuary, the relationship is more complicated as a result of the mixing of various sources of water or the removal of alkalinity. pH values increase with salinity. The variations in pH may be caused by the salinity-dependence of the apparent dissociation constants of carbonic acid. (Sims-ISWS)
W80-01267

EXPLORING DATA STRUCTURE OF NEW YORK BIGHT BENTHIC DATA USING POST-COLLECTION STRATIFICATION OF SAMPLES, AND LINEAR DISCRIMINANT ANALYSIS FOR SPECIES COMPOSITION COMPARISONS,
Rhode Island Univ., Kingston. Dept. of Experimental Statistics.
H. A. Walker, S. B. Saila, and E. L. Anderson.
Estuarine and Coastal Marine Science, Vol 9, No 2, p 101-120, August 1979. 10 Fig, 6 Tab, 22 Ref.

Descriptors: *Statistical analysis, *Atlantic Ocean, *Benthic fauna, *Environment, *Biological communities, Benthos, Marine biology, Sampling, Sediments, Particle size, Organic matter, Heavy metals, Waste dumps, Biology, Oceans, Analytical techniques, *New York Bight, Benthic environment, Environmental changes.

Techniques for exploring data structure from four cruises on a rectilinear sampling grid system on the New York Bight were presented. The problem of microenvironmental variability was handled by post-collection stratification of samples based on the physical characteristics of each grab rather than on classical spatial strata definitions. The three physical variables used to define strata were: mean particle size, percent organic matter, and total concentration of selected heavy metals. Variations in species densities within strata over time were investigated. Multivariate discriminant techniques were used to search for major statistical differences in a species abundance between strata. A flexible sampling program based on post-collection stratification was suggested to detect shifts in mean species abundance within strata over time. (Sims-ISWS)
W80-01287

BEHAVIOUR OF MANGANESE IN THE RHINE AND SCHELDT ESTUARIES, I. PHYSICO-CHEMICAL ASPECTS,
Brussels Univ. (Belgium). Lab. of Oceanography.
R. Wollast, G. Billen, and J. C. Duinker.
Estuarine and Coastal Marine Science, Vol 9, No 2, p 161-169, August 1979. 7 Fig, 1 Tab, 10 Ref.

Descriptors: *Manganese, *Estuaries, *Equilibrium, *Physicochemical properties, *Model studies, Mathematical models, Rivers, Heavy metals, Thermodynamics, Hydrogen ion concentration, Salinity, Coasts, Tidal waters, Chemicals, Oxygen, Chemistry, *North Sea coast.

An equilibrium model of the behavior of manganese during mixing of river water and seawater in estuaries was established on the basis of published thermodynamic data about manganes species in natural waters. The chemical control parameters taken into consideration were: ionic strength, pH, oxygen concentration, and total dissolved carbonate content. This model was shown to account for at least the general trends of dissolved manganese variations observed in the Rhine and Scheldt estuaries. Some data about the kinetics of the processes involved in manganese transformations in these two environments suggested that the close approach of the thermodynamic equilibrium is a consequence of the high turbidity and the intense microbiological activity present in these heavily polluted estuaries. (Sims-ISWS)
W80-01288

RADIOCARBON DATING OF A CORE FROM LONG ISLAND SOUND,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W80-01289

TIDALLY INDUCED RESIDUAL CURRENTS IN ESTUARIES OF VARIABLE BREADTH AND DEPTH,
Connecticut Univ., Groton Marine Sciences Inst.
J. P. Ianniello.
Journal of Physical Oceanography, Vol 9, No 5, p 962-974, September 1979. 5 Fig, 1 Tab, 18 Ref, 1 Append.

Descriptors: *Estuaries, *Currents(Water), *Tides, *Model studies, Mathematical models, Tidal waters, Circulation, Water circulation, Tidal streams, Equations, Winds, Depth, Channels, Flow, *Residual currents.

Analytic solutions were derived for the longitudinal and cross-channel Eulerian and Lagrangian residual currents induced in narrow tidal channels of variable breadth and depth, but rectangular cross section, by the nonlinear interactions of the first-order tides. The solutions were shown to be valid as long as the system is weakly nonlinear such that g eta sub o/sq sigma/sq Delta x is much less than 1, and as long as breadth variations are sufficiently gradual that f beta sub o/sigma/Delta x is much less than 1; beta sub o is a typical tidal amplitude, g is the acceleration of gravity, sigma the tidal frequency, Delta x the length scale over which the breadth changes, f the Coriolis parameter, and beta sub o the channel width. Results were given for channels with exponentially decreasing breadth and depth profiles and for a channel with a constriction in the breadth profile. These results indicated that significant differences from the residual currents in constant breadth and depth channels occur for all three types, but especially for the constricted channel. For this channel, a strong two-layer structure with a divergence in the surface water and a convergence in the bottom water, centered at the constriction, was generated for both the Eulerian and Lagrangian currents. This two-layer flow reinforces any two-layer density-induced circulation seaward of the constriction and opposes it landward of the constriction. The existence of a two-layer flow has important implications for the estuarine circulation; furthermore, since such a two-layer flow will not appear in depth-averaged models of the residual currents induced in narrow tidal channels, it may confound attempts to verify such models from measurements. (Sims-ISWS)
W80-01293

A REAL TIME MODEL OF NITROGEN-CYCLE DYNAMICS IN AN ESTUARINE SYSTEM,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynaics.
For primary bibliographic entry see Field 5C.
W80-01355

DISTRIBUTION OF INTERTIDAL DIATOMS ASSOCIATED WITH SEDIMENTS IN YAQUINA ESTUARY, OREGON,
Oregon State Univ., Corvallis, Dept. of Botany and Plant Pathology.
For primary bibliographic entry see Field 5C.
W80-01436

ASSIMILATION OF PARTICULATE ORGANIC CARBON BY ESTUARINE AND COASTAL COPEPODS,
City Univ. of New York.
For primary bibliographic entry see Field 5C.
W80-01453

MOVING BOUNDARY NUMERICAL SURGE MODEL,
Oak Ridge National Lab. TN.
G-T Yeh, and F.-K Chou.
Journal of the Waterway, Port, Coastal and Ocean Division, Amerian Society of Civil Engineers, Vol 105, No WW3, Proceedings Paper 14758, p 247-263, August 1979. 10 Fig, 1 Tab, 20 Ref.

Descriptors: *Storm surges, *Simulation analysis, *Maine, *Numerical analysis, *Mathematical models, *Gulf of Mexico, Hydraulics, Hydrodynamics, Model studies, Equations, *Boundary values, Finite difference method, Moving boundary models.

This paper adopts the time-split explicit (TSE) finite difference technique to simulate the storm surge on the vertically integrated hydrodynamic equations of continuity and momentum. The unique feature of the present model lies in its treatment of water-land interfaces as moving boundaries (MB). The conventional assumption of fixed boundary (FB) with a vertical wall located at the water-land interface of mean sea level is completely discarded. In the present model, the advancing and retreating of the surge wave over the low-lying dry land and the propagation of the water-land interface were dealt with on the basis of physical and mathematical principles. Numerical experiments indicated that the MB model predicts lower surge level at the coast line as much as 30% than the FB model when the adjacent inland area has a mild slope and the wind is very strong. The MB model yielded better agreement with recorded surge than the FB model, which consistently overpredicts the surge elevations. (Lee-ISWS)
W80-01456

STUDIES OF PHSOPHORUS MOVEMENT USING SALT MARSH MICROECOSYSTEMS,

Group 2L—Estuaries

Auburn Univ., AL.
J. W. Everest, and D. E. Davis.
Journal of Environmental Quality, Vol 8, No 4, Oct - Dec 1979, p 465-468. 1 Fig, 3 Tab, 16 Ref.

Descriptors: *Microecosystems, *Salt marshes, Phosphorus, Movement, Radioactivity, Smooth cordgrass, Diatoms, Mud fiddler crabs, Ribbed mussels, Marsh soil, Sea water.

Microecosystems of a salt marsh community were designed, constructed, and used to follow phosphorus flux through the physical biological components of that community. The biological components in these microecosystems were smooth cordgrass (Spartina alterniflora Loisel), diatoms, mud fiddler crabs (Uca pugnax Smith), periwinkle snails (Littorina irrorate Say), and ribbed mussels (Geukensia demissa Dillwyn; formerly Modiolus demisus Dillwyn). The physical components were the marsh soil and the seawater. Phosphorus 32p was secreted by the leaves of smooth cordgrass during the experiment. The rapid transfer of phosphorus to the soil surface was found to be the result of the burrowing activity of the fiddler crabs.
W80-01538

HYDROLOGY OF MAJOR ESTUARIES AND SOUNDS OF NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
G. L. Giese, H. B. Wilder, and G. G. Parker, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-299876, Price codes: A09 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-46, July 1979. 175 p, 95 Fig, 1 Plate, 14 Tab, 78 Ref.

Descriptors: *North Carolina, *Estuaries, *Saline water intrusion, *Tidal effects, *Water quality, Saline water-freshwater interfaces, Water chemistry, Sedimentation, Water level fluctuations, Wind tides, Hurricanes, Flow charactetiristics, Reservoir releases, *Albemarle Sound, *Pamlico Sound, Cape Fear River, Neuse River, Trent River, Tar River, Pamlico River, Chowan River, Roanoke River.

Knowledge of the basic hydrology of North Carolina's major estuaries and sounds is necessary to help solve hydrology-related estuarine problems which include contamination of some estuaries with municipal and industrial wastes and drainage from adjacent intensively-farmed areas, nuisance-level algal blooms, excessive shoaling in some navigation channels, saltwater intrusion into usually fresh estuarine reaches, too-high or too-low salinities in nursery areas for various estuarine species, and flood damages due to hurricanes. Saltwater intrusion occurs from time to time in all major estuaries in North Carolina except the Roanoke River, where releases from Roanoke Rapids Lake and other reservoirs during otherwise low-flow periods effectively block saline water from the estuary. (Woodard-USGS)
W80-01598

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

RESEARCH AND DEVELOPMENT ON A SPIRAL-WOUND MEMBRANE SYSTEM FOR SINGLE-STAGE SEAWATER DESALINATION,
Universal Oil Products Co., San Diego, CA. Fluid Systems Div.
R. L. Riley, and C. E. Milstead.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-114705, Price codes: A13 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, October 31, 1979. 284 p, 48 Fig, 97 Tab, 22 Ref, 2 Append. OWRT S-0098 (No 7543) (1), 14-34-0001-7543.

Descriptors: *Membranes, *Reverse Osmosis, *Desalination, *Sea water, Desalination processes, Desalination apparatus, Research and development, *Jeddah(Saudi Arabia), *Wrightsville Beach(NC), Water Factory 21-Orange County(CA), Spiral-wound elements.

Single-stage desalination of seawater by reverse osmosis requires a membrane which approaches theoretical semipermeability and is sufficiently thin to provide transport of water at practical operating pressures and recovery rates. This objective has been achieved by the development of a family of four thin-film composite membranes (TFC) based on nitrogen-containing polymers supported on a fabric-reinforced prorous supporting membrane. Long-term field testing of spiral-wound TFC membrane elements was conducted at the OWRT Test Facility at Wrightsville Beach, NC to determine the stability of the elements as functions of feed temperature, water recovery, dissolved oxygen, cleaning techniques, etc. In laboratory tests, the relative stability of each membrane was determined to materials commonly encountered during membrane storage and operation, e.g., cleaning agents, formaldehyde, sodium bisulfite, and sodium thiosulfate. The world's largest reverse osmosis system for seawater desalination, based on the newly developed spiral-wound TFC membrane elements, was placed on-line in 1979 to supply 12,000 cubic meters of desalted Red Sea water per day to the drinking water supplies of Jeddah, Saudi Arabia. Experience to date with the design, construction, installation, and operation of the plant has been consistent with expectations.
W80-01252

COMPRESSOR TECHNOLOGY AS RELATED TO VARIOUS FREEZE DESALINATION PROCESSES,
Chicago Bridge and Iron Co., Oak Brook, IL.
J. S. Andrepont, J. L. Seale, and W. A. Carpenter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119241, Price codes: A05 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, October 1979, 75 p. OWRT C-80327-S No (8559)(1), 14-34-0001-8559.

Descriptors: *Desalination apparatus, *Desalination processes, Freezing, Crystallization, *Compressor technology, Desalting.

The compressor requirements of various freeze desalination processes are dicussed and operating requirements of each compressor are included for plant size of 0.1, 1, 5 and 10 million gallons per day. The compressors involved in the various cycles fall into three categories: Closed loop refrigeration systems, open loop systems, and the water vapor compressor used in the vacuum freeze vapor compression process. Closed loop refrigeration compressors are standard, commercially available, refrigeration compressors. Open loop refrigeration compressors are also available but will require special attention due to erosion and corrosion problems associated with salt water entrainment. The water vapor compressor for the VFVC process is not commercially available at this time and will require a considerable amount of development work to produce a compressor suitable for this application.
W80-01374

PROCESS FOR THE DESALINATION OF SALT CONTAINING WATER,
D. W. Coillet.
U.S. Patent No 4,161,445, 5 p, 1 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 665-666, July 17, 1979.

Descriptors: *Patents, *Water treatment, *Desalination, *Water purification, *Sea water, Reverse osmosis, Ion exchange, Resins, Solar radiation, Thermal properties, Regeneration.

A water source such as sea water containing solar heat is passed through a reverse osmosis membrane and the permeate therefrom is passed through a bed of ion exchange resin to remove the contaminants and render the water potable. The solar heat present in the sea water is removed from the water prior to passage of the water through a reverse osmosis membrane and utilized to thermally regenerate the ion exchange resin. (Sinha-OEIS)
W80-01495

PROCESS FOR THE TREATMENT OF GROUND WATER,
D. W. Coillet.
U.S. Patent No 4,161,446, 6 p, 1 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 666, July 17, 1979.

Descriptors: *Patents, *Water treatment, *Desalination, *Water purification, *Water pollution treatment, Potable water, Ion exchange, Groundwater resources, Resins, Reverse osmosis, Thermal properties, Regeneration.

A water source such as ground water which contains impurities such as silica, sulfates, etc. and also contains geothermal heat is passed through a bed of anion exchange resin and a bed of cation exchange resin prior to treatment by passage over a thermal ion exchange desalination resin. The desalination resin is subsequently regenerated by hot water and the used regenerant is passed through a reverse osmosis membrane to remove the contaminants and thereby providing potable water. (Sinha-OEIS)
W80-01496

3B. Water Yield Improvement

GROUND-WATER STORAGE FOR CALIFORNIA WATER PROJECT,
California State Dept. of Water Resources, Los Angeles. Southern District.
For primary bibliographic entry see Field 6E.
W80-01282

3D. Conservation In Domestic and Municipal Use

HOUSEHOLD DEMAND FOR WATER AND POLICIES TO ENCOURAGE CONSERVATION,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
L. Clouser, and L. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111891, Price codes: A01 in paper copy, A01 in microfiche. Purdue University Water Resources Research Center Technical Report No. 124. August 1979. 67 p, 11 Tab, 41 Ref, 1 Append.

Descriptors: *Water conservation, *Water demand, *Water supply, *Domestic use, Population, Water shortage, Water storage, Water policy, Building codes, Water rates, *Water saving devices, *Water subsidies.

When a domestic water shortage occurs, the alternative usually investigated is increasing the supply, rather than decreasing the household demand. The authors studied two rural Indiana communities who were experiencing a water supply problem to determine the alternatives. People in general were not aware of available water saving devices for the home, and felt that water intensive appliances, such as dishwashers, automatic washing machines, etc., should be included in their present standard of living. The authors estimated that in a community of 600-1000 population, decreasing the demand for water by employing water saving kits would decrease the pumpage for the community by about 7.4 million gallons per year. The saving in water bills per household would range from $40-$60 annually or approximately $22,000 for the community. The alternative of increasing supply by digging a new well and providing more storage would cost about $1 million and raise minimum charges by 78 to 104 percent. It is suggested that subsidizing the installation of water saving kits could be accomplished for about $2000. Other means of controlling demand considered are taxation, regulation, and pricing. (Wiersma-Ind)

W80-01203

A STUDY OF FACTORS RELATED TO THE IMPLEMENTATION AND USE OF WATER CONSERVATION TECHNOLOGY IN MISSISSIPPI,
University of Southern Mississippi, Hattiesburg. School of Business Administration.
P. Cartee, and D. C. Williams, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112709, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, Mississippi State, Report, October 1979. 49 p, 14 Tab, 34 Ref, 3 Append. OWRT-A-120-MISS (1), 14-34-0001-9026.

Descriptors: *Water conservation, *Domestic water, *Municipal water, *Water rates, *Standards, Local governments, State governments, Mississippi, Homebuilders associations, Speculatively built single-family houses, Municipal water supplies, Low-flow shower heads, Water saving toilets, Faucet aerators, Water saving appliances, Insulated hot water lines, Energy efficient hot water heaters, Single family marketing.

This project was purposed with determining the awareness, status, and current usage of domestic water conserving technology in selected areas of Mississippi. Home builders and municipal officials were surveyed to gather pertinent data. Home builders were found to exercise the greatest selection responsibility in choosing water consuming equipment in speculatively-built houses followed next by the plumbing contractor. Only 60 percent of the builders indicated the use of one or more water conserving items in their construction, mostly water conserving toilets and energy efficient hot water heaters. Conservation aspects of equipment were not found to influence builder choices significantly as they felt it added little to marketability. Only about 22 percent felt that buyers would pay over $100 for such items. Local codes were not viewed as a deterrent. Almost all of the municipalities viewed their water supplies as adequate; none had mandated water conserving equipment requirements; most used the declining block rate structure and felt that rate manipulation would not produce significant savings. Attempts at mandated, state level water conservation via equipment regulations have not been successful.
W80-01259

RESIDENTIAL WATER CONSUMPTION IN RENO - SPARKS, NEVADA,
Nevada Univ. System, Reno. Water Resources Center.
V. L. Gupta, and D. E. Carlson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116312, Price codes: A04 in paper copy, A01 in microfiche. Publication No 41059, October 1979, 45 p, 10 Fig, 5 Tab, 13 Ref. OWRT B-095-NEV (1), 14-34-0001-7167.

Descriptors: *Water conservation, *Domestic water, *Water loss, Equipment, Water delivery, Pipes, Plumbing, *Residential water consumption, Opinion survey, Nevada, Reno-Sparks(NV).

This report describes the results of a limited-scale field survey conducted in Reno-Sparks, Nevada concerning the general patterns of the indoor and outdoor components of residential water consumption. A total of twenty-three homes were metered in two-week intervals to obtain the data base. Coupled with this effort was an attitude and opinion survey directed toward a randomly selected group of 1000 residents in the study area, with about 34 percent responding to the inquiries. A majority of the respondents indicated a strong desire toward the implementation of some form of water conservation.
W80-01377

3F. Conservation In Agriculture

BUBBLER SPRINKLER,
R. W. von Lutzow.
U.S. Patent No 4,159,805, 4 p, 4 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 1, p 95, July 3, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Application equipment, Flushing.

A new and improved bubbler head is provided for a water irrigation system which is formed of non-metallic parts, such as from suitable plastics which do not corrode or are not effected by electrolysis and may be easily adjusted and retain its adjustment for long periods of time to provide the right amount of water for the area being watered. The bubbler head is easily hand adjusted to remove any clogging or water flow restricting debris by a slight turning of the bubbler head which flushes out the internal parts of the bubbler after which the bubbler head is turned back to its desired water controlled flow. (Sinha-OEIS)
W80-01474

ALIGNMENT CONTROL APPARATUS FOR A SELF-PROPELLED IRRIGATION SYSTEM,
Tumac Industries, Inc., Colorado Springs, CO. (Assignee).
J. R. McConnell.
U.S. Patent No 4,161,185, 10 p, 8 Fig, 19 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 579-580, July 17, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Control systems, Irrigation practices, Irrigation efficiency, Equipment, Valves, Alignment control.

An alignment control for a self-propelled irrigation system maintains adjacent pipe segments of the system in a predetermined alignment and includes an elongated actuation arm pivotally mounted near its center for movement about a vertical axis. One end portion of the arm is spring biased against one of the pipe segments and the other end is operably connected to a control valve which runs one of the self-propelled support towers of the irrigation system. In the preferred embodiment, the end portion abutting the pipe segment is bifurcated into two legs which vertically straddle a section of the pipe segment. The spring biases one of the legs toward an abutting relationship with the pipe section making the actuation arm very sensitive and responsive to misalignments of the adjacent pipe segments. The valve housing for the control valve is also mounted for pivotal movement and the second end portion of the actuation arm is adjustably connected to the valve control member so that the alignment control system can be adjusted to maintain adjacent pipe segments at any desired relative angle to each other. (Sinha-OEIS)
W80-01489

WATERING DEVICE,
J. E. Hill.
U.S. Patent No 4,161,290, 3 p, 4 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 616, July 17, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Flow control.

A fitting coupled to a water source comprises an orifice, means for regulating the quantity of water passing through it, an abutment for the water and a laterally displaced water outlet means. The fitting has a mixing or turbulence-causing chamber to allow for the bubbling release of water. (Sinha-OEIS)
W80-01491

EMITTER,
C. Bentley.
U.S. Patent No 4,161,291, 7 p, 15 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 616, July 17, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Flow control, *Drip irrigation, Emitters.

An emitter for use in drip irrigation comprises a chamber and a resilient element having opposite faces mounted in the emitter chamber with the first face confronting a surface of the emitter chamber. The surface of the emitter chamber and the first face cooperate to define a restricted fluid passage. The emitter body has an inlet for supplying water under pressure to the emitter chamber and an outlet leading from the fluid passage. The resilient element as an aperture between the second face and the fluid passage so that water can pass from the inlet through the aperture and the fluid passage to the outlet. The pressure drop across the aperture is increased to hold the first face of the resilient element against the surface of the emitter chamber to maintain the integrity of the fluid passage. This may be accomplished by utilizing one or more slits for the aperture or by providing a suitable valve member in the aperture. (Sinha-OEIS)
W80-01492

CENTER PIVOT IRRIGATION SYSTEM HAVING APPARATUS FOR IRRIGATING CORNERS,
Lockwood Corporation, Gering, NE. (Assignee).
H. L. Holloway, and E. M. Norum, Jr.
U.S. Patent No 4,161,292, 16 p, 7 Fig, 2 Tab, 14 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 617, July 17, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Sprinkler irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Control systems, Timing, Nozzles.

A center pivot irrigation system has first and second auxiliary nozzles, or end guns, alternately operable for irrigating substantial portions of corner regions. The system includes a main pipeline sprinkler having main fluid discharge nozzles for irrigating a central, generally circular area, and the end guns are connected to the main pipeline sprinkler and draw water from it. When a corner is approached, one of the end guns is actuated while maintaining actuation of the main fluid discharge nozzles. A short period of time thereafter, the second end gun is actuated, and the pivotal rate of the main pipeline sprinkler is reduced to zero. At this time the main fluid discharge nozzles and the first end gun are closed, thereby providing all of the water from the main pipeline sprinkler to the operating end gun. After a predetermined time period, the second end gun is inactivated, the first gun and the main nozzles are reactivated, and the system is pivoted to a new orientation. After several such sequences and the corner has been passed, only the main nozzles are actuated until another corner is approached. Timers are provided for determining the duration of the periods during which the water is being discharged through the various nozzles to allow effective control of the amount of irrigation water discharged. (Sinha-OEIS)
W80-01493

SPHERICAL IRRIGATION PIPE COUPLING WITH REPLACEABLE SEAL,
Gifford-Hill and Co., Inc., Spokane, WA. (Assignee).
J. E. Hansen.
U.S. Patent No 4,161,331, 10 p, 4 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 629-630, July 17, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Pipes, *Joints(Connections), Sealants, Application equipment, Irrigation practices, Irrigation efficiency, Couplings, Articulation.

Irrigation pipe couplings for movable irrigation systems include a spherical coupling structure that allows articulation of sections of the irrigation pipe during operation of the irrigation system. A sealing element is provided that maintains a positive seal when the various sections of irrigation pipe are static or are moving. The internal and external components of the coupling structure and the sealing element of each of the couplings cooperate in such manner that the sealing elements are easily and quickly replaceable should they become worn or damaged. It is not necessary to cause longitudi-

nal separation of the sections of pipe in order to achieve replacement of the sealing element. A portion of the external part of the coupling structure provides support for one extremity of one of the pipe sections that are couples, both in normal operation and during replacement of the sealing element. (Sinha-OEIS)
W80-01494

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

PRODUCTION OF REPRODUCTIVELY LIMITED GRASS CARP FOR BIOLOGICAL CONTROL OF AQUATIC WEEDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Agricultures.
W. L. Shelton, and G. L. Jensen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-114713, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Research Institute Auburn University, WRRI Bulletin 39, September 1979, 174 p, 2 Fig, 21 Tab. OWRT B-075-ALA (1), 14-34-0001-8055.

Descriptors: *Aquatic, *Weed control, *Fish, Fish genetics, *Fish reproduction, *Grass carp, Sex reversing, Aquatic macrophytes.

The need for a biological aquatic weed control is increasingly evident as the cost-effectiveness and environmental concerns make chemical treatment less desirable. The grass carp, a native fish of Southeast Asia is an effective consumer of aquatic macrophytes. However, potential adverse environmental impact must be considered when an exotic animal is proposed for introduction. Unwanted reproduction and subsequent naturalization is the greatest fear that biologists in the U. S. hold for grass carp. No reproduction would be possible if only a single sex were stocked but an efficient technique to monosex grass carp has not been available. This study applied experience gained with hormone sex reversing of tilapias and modified the methods to suit specializations of grass carp. Functional sex reversal was the objective of the study but the ultimate goal was to use these fish as brood fish that would yield only single sex offspring. This approach depends on the stability of the sex determining mechanisms but if it is substantiated sufficient numbers of monosex fish can be inexpensively produced.
W80-01254

EFFECTS OF DRAINAGE PROJECTS ON SURFACE RUNOFF FROM WETLAND TOPOGRAPHY OF THE NORTH CENTRAL STATES,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
I. D. Moore, and C. L. Larson.
Paper No. NCR 76-203 presented at the 1976 Annual Meeting of North Central Region, American Society of Agricultural Engineers and Manitoba Region, Canadian Society of Agricultural Engineering, Winnipeg. 21 p, 2 Fig, 17 Ref, Append, ASAE, St. Joseph, Michigan. OWRT-B-122-MINN (3), 14-31-0001-6092.

Descriptors: *Wetlands, *Drainage, *Flood flow, *Runoff, Environmental effects, Evaluation, Statistical methods, *North central states.

Drainage of wetlands has for many years been a controversial subject. The background to the problem is dicussed, in particular the allegation that drainage projects aggravate floods. Both statistical analysis of historical data and watershed modeling techniques are used. This paper shows that statistical analysis alone is incapable of resolving the problem at the present time. (Blake-Minn)
W80-01263

CHEMICAL COMPOSITION OF AQUATIC MACROPHYTES, I. INVESTIGATION OF ORGANIC CONSTITUENTS AND NUTRITIONAL POTENTIAL,
Guelph Univ. (Ontario). Coll. of Biological Science.
For primary bibliographic entry see Field 5C
W80-01352

THE BIOLOGY OF CANADIAN WEEDS. 34. MYRIOPHYLLUM SPICATUM L.,
Minnesota Univ., St. Paul. Dept. of Botany.
S. G. Aiken, P. R. Newroth, and I. Wile.
Canadian Journal of Plant Science, Vol 59, No 1, p 201-215, January 1979. 19 Fig, 1 Tab, 65 Ref.

Descriptors: *Biology, *Speciation, *Aquatic weeds, *Water hyacinth, *Aquatic weed control, *Herbicides, *Eurasian watermilfoil, diseases, Growth rates, Distribution, Ecological distribution, Reproduction, Plant physiology, Habitats, Economic impact, Submerged plants, Canada, Lakes, Aquatic plants, Floating plants, Invasion, Competition, 2,4-D, Diquat, Paraquat.

An overview of Myriophyllum spicatum (Eurasian water-milfoil) and its particular occurrence in Canadian lakes and rivers covers species variation, economic importance, geographic distribution, habitat, history, growth and development, reproduction, hybrids, population dynamics, response to herbicides and other human manipulations, and response to parasites. This weed species was introduced from Eurasia and has spread throughout the U.S. and into British Columbia and lakes and rivers in eastern Canada along the St. Lawrence Seaway M. spicatum is much more aggressive than native watermilfoils, M. verticillatum and M. exalbescens Eurasian watermilfoil flourishes in eutrophic lakes and in waterways enriched with nutrients. It grows in 1-10 M water depths, whereas M. exalbescens is limited to 0.5-2.5 m and M. verticillatum is limited to 1-3 m. M. spicatum invades submerged aquatic plant communities and within two to three years, competitively displaces most other plants. It is highly susceptible to 2,4-D; control occurs in 48 h with 1.0 ppm 2,4-0 concentration, all plants are killed when exposed to five ppm treatments for only one h. Repeated mechanical harvesting, rototilling, diver-operated dredges, and water level drawndown have been used to control M. spicatum. No insect parasites in North America are known. Lake Venice disease, an attack by microorganisms, occurred in 1962 in Maryland populations, however, no specific pathogen has been found for this disease. (Danovich-Wisconsin)
W80-01362

PROCEEDINGS: STORMWATER MANAGEMENT MODEL (SWMM) USERS GROUP MEETING, NOVEMBER 13-14, 1978.
For primary bibliographic entry see Field 6A.
W80-01389

FLOOD PLAIN INFORMATION: CUCHARAS RIVER AND TRIBUTARIES, LA VETA, COLORADO,
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-01400

FLOOD PLAIN INFORMATION: CUCHARAS RIVER AND TRIBUTARIES, WALSENBURG, COLORADO,
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-01401

FLOOD PLAIN INFORMATION: GILMORE CREEK, BURNS VALLEY CREEK, PLEASANT VALLEY CREEK, VICINITY OF WINONA, MINNESOTA,
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 2E.
W80-01403

FLOOD HAZARD INFORMATION: ANIMAS RIVER AND HERMOSA CREEK, HERMOSA, COLORADO,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W80-01412

FLOOD HAZARD INFORMATION: COLORADO RIVER AND TRIBUTARIES: FRUITA, CO,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W80-01413

FLOOD HAZARD INFORMATION: YAMPA RIVER AND TRIBUTARIES, CRAIG, COLORADO,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W80-01414

FLOOD HAZARD INFORMATION: COLORADO RIVER AND TRIBUTARIES, GRAND JUNCTION, COLORADO,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W80-01415

THE WATER HYACINTH: FROM PROLIFIC PEST TO POTENTIAL PROVIDER,
National Space Technology Labs., NSTL Station, MS.
B. C. Wolverton, and R. C. McDonald.
Ambio, Vol 8, No 1, p 2-9, 1979. 6 Fig, 5 Tab, 30 Ref.

Descriptors: *Water hyacinth, *Invasion, *Aquatic weed control, *Beneficial use, *Waste water treatment, Aquatic weeds, Geographical regions, Growth rates, Productivity, Trophic level, Climatic zones, Eutrophication, Fertilizers, Nutrient removal, Water purification, Biomass, Benefits, Harvesting, Waste assimilative capacity, Bioaccumulation.

Although current infestations of water hyacinth (Eichhornia crassipes) in Florida, Louisiana, and Texas cover 700,000 waterway ha and cost these three states alone over $11 million/yr for control, studies show that water hyacinths can be beneficially used for large-scale nutrient removal and water purification. Domestic waste treatment chemical waste treatment, growth rate and harvesting, and product development to utilize biomass quantities care. All under review at present, water water hyacinth systems are limited to freshwater systems in warm climates. With a wastewater retention time of seven d, water hyacinths yearly reduce BOD 70% from 50 mg/l influent levels to 15 mg/l effluent levels. Suspended solids are reduced from 49 mg/l average influent levels to 14 mg/l effluent levels. Nutrients are reclaimed from the water and form plant biomass and water is restored to receiving stream quality. Water hyacinth's unique survival capacity enables it to absorb and concentrate heavy metals without visible toxicity signs. A system using water hyacinths and receiving 95,000 l/d chemically polluted wastewater, reduced BOD by 97% and COD by 88%. Water hyacinth harvesting and productivity studies show an overall average 46% increase in weight per week at maximum growth rates. Other products which can be made from water hyacinths include cattle feed supplements, protein concentrate for human food, organic fertilizer and soil conditioner, and biogas containing high methane percentage. (Danovich-Wisconsin)
W80-01457

DOWNSPOUT RECEIVER AND WATER DISPENSING DEVICE,
C. L. Sitarz.
U.S. Patent No 4,161,186, 4 p, 3 Fig, 8 Ref; Official Gazette of the United States Patent Office. Vol 984, No 3, p 580, July 17, 1979.

Descriptors: *Patents, *Drainage water, *Storm runoff, Drainage systems, Storm drains, Subsurface drains.

Most towns and cities require that downspouts be disconnected from the main sewer system of the building and instead be arranged so that they discharge outwardly from the building in order to prevent overloading of the sewer system. This invention provides a substantially hollow receiver which is buried in the ground remote from the lower end of the downspout and is connected to the downspout by buried conduit. A pop-up type lid or cover is provided which normally rests flush upon the upper end of the receiver level with the ground, but which moves upwardly under water pressure when water is flowing through the downspout. This water is then discharged circumferentially around the periphery of the receiver so that wash-aways are prevented. When the water pressure drops, the lid or cover returns to the closed position by gravity or by a light spring if desired, thereby preventing the ingress of dirt, dust and the like into the receiver and also preventing accidents from occuring to people who might be walking in the general area of the receiver. (Sinha-OEIS)
W80-01490

4B. Groundwater Management

HYDROGEOLOGIC DATA FOR THE BEAR CREEK SUBSURFACE-INJECTION TEST SITE, ST. PETERSBURG, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. J. Hickey, and G. L. Barr.
Geological Survey open-file report 78-853, 1979. 53 p, 10 Fig, 17 Tab, 20 Ref.

Descriptors: *Injection wells, *Underground storage, *Artificial recharge, *Storm runoff, *Aquifer characteristics, Hydrologic properties, Water supply, Water demand, Test wells, Water quality, Hydrogeology, Petrology, Aquifer management, Florida, *St. Petersburg(FL).

Lithologic, hydraulic, geophysical, and water-quality data were collected at the Bear Creek subsurface-injection test site at St. Petersburg, FL. The data were collected to determine the feasibility of subsurface injection of storm runoff. An exploratory hole and five observation wells were constructed between October 1974 and April 1976. The lithology of the upper 185 feet at the test site is predominantly sand and marl. From 185 feet to 3,504 feet, limestone and dolomite predominate. Also, gypsum is present below 1.290 feet. Vertical intrinsic permeability, porosity, and compressibility of cores are reported. A 73-hour withdrawal test discharging 3,450 gallons per minute was run in the test injection well. At the site, chloride concentration in water from 192 to 340 feet, ranged from 150 to 680 milligrams per liter, and from 500 to 1,267 feet ranged from 16,000 to 20,000 milligrams per liter. Eleven additional wells near the test site were sampled for water quality. (Woodard-USGS)
W80-01419

HYDROGEOLOGIC DATA FOR THE SOUTH CROSS BAYOU SUBSURFACE-INJECTION TEST SITE, PINELLAS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. J. Hickey.
Geological Survey open-file report 78-575, 1979. 87 p, 13 Fig, 27 Tab, 21 Ref.

Descriptors: *Injection wells, *Artificial recharge, *Aquifer characteristics, *Water quality, *Test wells, Aquifer management, Data collections, Sampling, Monitoring, Hydrologic data, Florida, *Pinellas County(FL).

One exploratory hole, a test injection well, and nine monitor wells were constructed at the South Cross Bayou test-injection site between January 1973 and October 1975. At the test site, the first 125 feet below land surface is predominantly limestone and clay; from 125 to 3,280 feet it is mostly limestone and dolomite. Gypsum is also present below 1,260 feet. Wells within about a 1-mi radius of the test injection site were sampled and analyzed to provide water-quality background data prior to anticipated long-term injection at the test site. Locations of the wells sampled are shown, reported construction data are given, and the chemical analyses of water from these wells are tabulated. Chloride concentration of water from the wells near the test site ranged between 9.8 to 290 mg/L. Reported depth of these wells ranged from 25 to 302 ft. (Woodard-USGS)
W80-01421

APPRAISAL OF UNCONTROLLED FLOWING ARTESIAN WELLS IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. G. Healy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102239, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-95, 1978. 26 p, 7 Fig, 2 Tab.

Descriptors: *Artesian wells, *Aquifers, *Subsurface flow, Springs, *Florida, Discharge(Water), Water quality, Aquifer management, Aquifer characteristics, *Uncontrolled flowing wells.

An estimated 15,000 uncontrolled flowing wells, many discharging water of poor quality are wastefully discharging about 790 million gallons per day by surface and internal flow. Internal flow in principal problem areas have been identified in Brevard, Charlotte, Clay, De Soto, Duval, Flagler, Glades, Hendry, Hillsborough, Lee, Manatee, Martin, Nassau, and Sarasota Counties. In many areas, uncontrolled discharge over the years has caused a decline in the potentiometric surface locally and regionally, and a deterioration of the potable water aquifers. Programs for control of flowing wells are being carried on by State, county, municipal, or Federal agencies in 21 countries. (Woodard-USGS)
W80-01423

GROUND-WATER MONITORING AT SANTA BARBARA, CALIFORNIA, PHASE 1--COASTAL MONITOR-WELL INSTALLATION AND INITIAL MEASUREMENTS,
Geological Survey, Menlo Park, CA. Water Resources Div.
C. B. Hutchinson.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, microfiche $3.50, paper copy $3.50. Geological Survey open-file report 79-923, July 1979. 24 p, 7 Fig, 4 Tab, 6 Ref.

Descriptors: *Saline water intrusion, *Probability, *Drawdown, *Aquifers, *Observation wells, Pumping, Water analysis, Water quality, Dissolved solids, Chlorides, Aquifer characteristics, Groundwater movement, Hydrology, Well data, Lithologic logs, Aquifer management, Testing procedures, Monitoring, *Santa Barbara(CA).

Plans to reduce natural ground-water storage in the 7-square-mile Santa Barbara groundwater basin have caused concern about possible saltwater intrusion into the coastal freshwater aquifer. To give advance warning of such intrusion, two multipiezometer wells were installed along the coast, about half a mile and 1 mile from the pumping center. Each site contains four small-diameter wells, completed at depths between 95 and 800 feet, which monitor water levels and water quality in (1) the shallow zone above the producing zones, (2) the upper producing zone, (3) the lower producing zone, and (4) the deep zone below the producing zones. The wells were measured and sampled initially in September 1978 during a 2-million gallons per day pumping phase of the municipal supply wells. In the eight samples collected, dissolved-solids concentrations ranged from 450 to 6,290 mg/L and chloride concentrations ranged from 35 to 2,800 mg/L. At the site farther from the center of pumping, the well monitoring the upper producing zone was the only one with a water level below sea level, and it produced the water of poorest quality. At the site nearer the center of pumping, water levels in both producing zones and the deep zone were between 2 and 18 feet below sea level, with the water of poorest quality occurring in the lower producing zone. Although the dissolved-solids concentrations are high in several zones, the potential for saltwater intrusion can be reliably evaluated only after analysis of long-term records. (Woodard-USGS)
W80-01433

THE ALLOCATION OF PERCOLATING WATER UNDER THE OKLAHOMA GROUND WATER LAW OF 1972,
Tulsa Univ., OK.
For primary bibliographic entry see Field 6E.
W80-01552

WATER MANAGEMENT OF THE FUTURE: A GROUNDWATER STORAGE PROGRAM FOR THE CALIFORNIA STATE WATER PROJECT,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 6E.
W80-01553

BEYOND SECTION 858: A PROPOSAL GROUND-WATER LIABILITY AND MANAGEMENT SYSTEM FOR THE EASTERN UNITED STATES,
National Energy Law and Policy Inst., OK.
For primary bibliographic entry see Field 6E.
W80-01554

LONG-TERM WATER SUPPLY POTENTIAL, GREEN SWAMP AREA, FLORIDA,
Geological survey, Tallahassee, FL. Water Resources Div.
H. F. Grubb, and A. T. Rutledge.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102270. Price codes: A05 in paper copy. A01 in microfiche. Geological Survey Water-Resources Investigations 78-99, 1979. 76 p, 37 Fig, 5 Tab, 29 Ref.

Descriptors: *Groundwater resources, *Surface-groundwater relationships, *Florida, *Swamps, *Water supply, Model studies, Hydrogeology, Simulation analysis, Inflow, Discharge(Water), Aquifer characteristics, Pumping, Water yield, Drawdown, Groundwater recharge, Leakage, Induced infiltration, *Green Swamp area(FL), *Floridan aquifer.

The Green Swamp is an 870 square-mile area of interspersed swamps and flat uplands located in central Florida about 20 miles west of Orlando and about 30 miles northeast of Tampa. Estimates of principal water budget items are (1) inflow, 52.10 inches of rainfall and less than one-half inch of ground-water inflow and (2) outflow, 10 inches of surface runoff, 2 inches of ground-water outlfow, and 40 inches of evapotranspiration. The effects of large-scale pumping from the Floridan aquifer were evaluated using a steady-state finite-difference ground-water flow model. The average simulated drawdown in the modeled area was 2 feet for a withdrawal rate of 91 million gallons per day from 6 pumping centers, 4 feet for a withdrawal rate of 183 million gallons per day from 12 pumping centers, and 6 feet for a withdrawal rate of 274 million gallons per day from 18 pumping centers. The 274 million gallons per day is equivalent to the estimated natural ground-water outflow plus about 45 percent of the runoff from the Green Swamp. (Woodard-USGS)
W80-01588

SALTWATER ENCROACHMENT IN THE '600-FOOT' AND '1,500-FOOT' SANDS OF THE BATON ROUGE AREA, LOUISIANA, 1966-78, INCLUDING A DISCUSSION OF SALTWATER IN OTHER SANDS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-01594

4C. Effects On Water Of Man's Non-Water Activities

A COMPARATIVE APPLICATION OF SEVERAL METHODS FOR THE DESIGN OF STORM SEWERS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
B. Burke, and D. D. Gray.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-114721, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No 118, August 1979. 134 p, 40 Fig, 42 Tab, 28 Ref, 2 Append. OWRT A-057-IND (1), C-6106 (No 5213) (12).

Descriptors: *Urban drainage, *Drainage systems, *Unit hydrographs, *Rational formula, Urban runoff, Storm runoff, Sewers, Storm drains, Simulated rainfall, Peak discharged, Precipitation intensity.

Four methods which may be employed in the design and analysis of urban drainage systems were investigated:the National method, the Illinois Urban Drainage Area Simulator (ILLUDAS), the Soil Conservation Curve Number Method (CN) and the instantaneous unit hydrograph of Sarma, Delleur, and Rao (SDR). These methods were applied to two subdivisions: Fair Oaks Estates located in Carol Stream, Illinois, and Bar Berry Heights in West Lafayette, Indiana. Recommendations for the most effective use of each method are presented. In the comparisons made it was concluded that ILLUDAS was the most useful. The required input data are not excessive and the program is relatively easy to apply for various conditions. Use of the rational method is not recommended because it requires too much engineering judgement and too many hand calculations to allow the investigation of many differing conditions or alternative designs. Volumes computed using the CN method were found to be low when compared to the ILLUDAS results. The peak flow rates determined by the SDR method were also low. (Wiersma-Ind)
W80-01253

WATER QUALITY AND CONSTRUCTION: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
July 1979. 108 p, 53 Ref, 13 Tab, 13 Fig. EPA P004198010.

Descriptors: *Water quality, *North Carolina, *Sediment control, *Erosion, *Stream erosion, *Erosion control, *Sedimentation Pollution Control Act of 1973, *Construction, *Surface runoff, Water management, Sedimentation, Bank erosion, Stream degradation, Channel erosion, Structural improvements, Road construction, Water pollution, Surface drainage.

This report, part of North Carolina's Water Quality Management Plan, is an assessment of the erosion and sedimentation caused by construction activities within North Carolina. More than 15,000 acres in the state are exposed each year by construction activities. Non-highway construction activities are centered in the more metropolitan counties while highway construction is widely distributed across the state. Impacts from construction activities are centered around excessive sedimentation which causes biological and physical degradation of streams, ponds and lakes. Secondary impacts from construction occur once construction has ceased and include the following: streambank degradation, erosion of roadbanks and roadsides, and sediment from unpaved roads. Three basic categories of practices exist for preventing sediment eroded on construction sites from entering watercourses: surface protection measures, runoff water control measures and sediment trapping measures. The Sedimentation Pollution Control Act of 1973 (the SPCA) is the state's regulatory law on which the most significant and effective programs are based. Federal programs which influence erosion control are wastewater facility construction grants, the National Environmental Policy Act and the dredge and fill material permit program. Erosion control has improved since the SPCA was enacted in 1973 but some significant problems still remain. More attention needs to be placed on every aspect of erosion control, from submission and design of plans to the maintenance of devices that are used for erosion control. (Iervolino-NC)
W80-01398

WATER QUALITY AND URBAN STORMWATER: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
July 1979. 89 p, 55 Ref, 29 Fig, 3 Tab, 3 Append. EPA P004298010.

Descriptors: *Urban hydrology, *Water quality, *Urban storm water, *Storm water, *Urban stream pollution, *Water pollution, *Water pollution control, *North Carolina, *Water quality control, Urban drainage, Urban runoff, Storm runoff, Surface runoff, Water pollution sources, Water pollution effects, Water pollution treatment, Water management(Applied).

This report, part of North Carolina's Water Quality Management Plan, is an assessment of the pollution caused by urban stormwater in North Carolina. Information was gathered on: (1) extent of urbanization in the state; (2) sources and typical impacts of urban pollutants; (3) ways to mitigate adverse impacts; (4) programs which currently affect stormwater control and their effectiveness; and (5) continuing water quality problems as demonstrated through monitoring results. In 1970 only 23.9% of the state's population lived in urban areas, in contrast to 58.3% nationwide. Sources of urban stream pollution include atmospheric sources, transportation residue, particulates accumulation, urban litter, chemicals usage, fertilizer and pesticide usage, enteric microorganism sources, unpermitted point sources, construction activities and streambank degradation. The impacts of this pollution are: oxygen depletion, nutrient over-enrichment, toxics and enteric microorganism contamination, sediment accumulation, biological degradation and altered hydrologic characteristics. The plan also reports on the following studies which have been conducted to determine the extent of degradation of urban streams; Third Fork Creek Study, Triangle J Study, Land of Sky Study, Winston-Salem Study, and the Raleigh Area Study. Both physical/chemical measurements and biological sampling were taken in all the studies. The studies have shown that, under present conditions, almost all urban streams will be unable to meet the 1983 water quality standards. The following practices are recommended: street cleaning, catch basin cleaning, covering chemical stockpiles, small-scale detention basins, erosion control and litter control. (Iervolino-NC)
W80-01399

EFFECTS OF PAVED SURFACES ON RECHARGE TO THE FLORIDAN AQUIFER IN EAST-CENTRAL FLORIDA--A CONCEPTUAL MODEL,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. H. Tibbals.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 318, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-76, 1978. 42 p, 10 Fig, 3 Tab, 8 Ref

Descriptors: *Groundwater recharge, *Paving, *Effects, *Artesian aquifers, *Model studies, Computer models, Analytical techniques, Equations, Hydrogeology, Aquifer characteristics, Potentiometric level, Rainfall-runoff relationships, Florida, *Floridan aquifer, *East-Central Florida.

The proportionate amount of surface area that can be paved in Floridan aquifer recharge areas in east-central Florida without reducing the net recharge to the Floridan aquifer is a function of many variables that include rainfall, depth to water table, depth to potentiometric surface of the Floridan, evaporation from paved areas, evapotranspiration from unpaved areas, runoff, pattern of paving, and leakance coefficient of the confining beds. Equations that incorporate those variables, except pattern of paving, are developed and coupled to produce a conceptual model that estimates relative amounts of water available for recharge and percentage of unpaved area below which Floridan aquifer recharge rates must increase. The model is not intended to be used as a basis for engineering design. Rather, its purpose is to show approximate mathematical interrelations of rainfall, runoff, evapotranspiration, percentage of paving, and Floridan aquifer recharge, and to make quantitative estimates of amounts of water available for Floridan aquifer recharge before and after paving. The allowable percentage of paving calculated in four examples ranges from 86.8 percent to 3.6 percent. (Woodard-USGS)
W80-01428

A DWINDLING WATER SUPPLY AND THE INDIAN STRUGGLE TO RETAIN ABORIGINAL AND WINTERS DOCTRINE WATER RIGHTS.
United Effort Trust, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-01576

4D. Watershed Protection

RUNOFF AND EROSION REDUCTION VIA DRAINAGE AND INCREASED INFILTRATION,
Pennsylvania State Univ., University Park, Coll. of Agriculture.
A. R. Jarrett, and J. R. Hoover.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111917, Price codes: A04 in paper copy, A01 in microfiche.

Descriptors: *Runoff, *Erosion control, *Drainage, *Infiltration, Soils, Rainfall-runoff relationships, Water table, Soil profiles, Subsurface drainage, Moisture, Laboratory tests, Methodology, *Erosion reduction, *Soil air, Nonpoint source pollution, Air entrapment, Fragipan, Tillage, Gas pressure.

The study investigated the effect of soil air entrapment on filtration runoff and erosion and the possibilities of reducing the negative effects. Four laboratory studies are reported. An infiltration model for infiltration under trapped air conditions based on a modified Green and Ampt (1911) equation was developed. Infiltration of high intensity rainfall into soils, containing shallow water tables or relatively impermeable layers, is reduced and in some cases virtually stopped if the soil air cannot move laterally to a venting location. The release of entrapped soil air through subsurface drainage systems placed at the depth of the restrictive layer or through surface soil pores can increase the infiltration rate where up to twice as much of the rainfall will enter the soil during short duration summer storms which often occur when the soil is relatively dry. This enhanced infiltration reduces the quantity of surface runoff resulting in less erosion and providing a method of nonstructural flood control on some small watersheds. (Tsong-Penn)
W80-01202

WATER QUALITY AND AGRICULTURE: A MANAGEMENT PLAN,
North Carolina Soil and Water Conservation Commission, Raleigh. Div. of Land Resources.
For primary bibliographic entry see Field 5G
W80-01393

WATER QUALITY AND FORESTRY: A MANAGEMENT PLAN.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management
For primary bibliographic entry see Field 5G
W80-01396

WATER QUALITY AND CONSTRUCTION: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 4C.
W80-01398

THE EFFECT OF MAINTENANCE ON STORM WATER DETENTION BASIN EFFICIENCY,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01582

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

THE DETERMINATION OF CYANIDE ION IN NATURAL WATERS WITH A SELECTIVE ION ELECTRODE,
Southern Illinois Univ. at Edwardsville. Dept. of Chemistry.
D. G. Rands, and R. L. Bain.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113590, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois, Urbana Research Report No. 143, October 1979. 18 p, 5 Tab, 6 Ref. OWRT-A-089-ILL (1), 14-31-0001-8015.

Descriptors: *Water analysis, *Ions, *Electrodes, *Analytical techniques, Laboratory equipment, *Cyanide ion concentration, Natural waters.

The analysis of cyanide ion in natural water systems is complicated by the fact that natural waters contain certain metal ions which form extremely stable metal-cyano complexes. Current methods involve distillation techniques to separate cyanide from the samples in order to permit the anlaysis. However, certain metalcyano complexes are so stable thermodynamically and release complexed cyanide so slowly that even those methods are not very satisfactory. We have investigated an approach to secure the release of cyanide ion in the water sample so that a direct measurement with a selective ion electrode can be used. The proposed technique is based upon the addition of an organic ligand to the sample which will form a metal complex sufficiently stable to release a quantitative amount of cyanide from metal-cyano complexes. We have shown that the complexing agents investigated will release 60-80% of complexed cyanide during simultaneous reflux and irradiation by a mercury lamp. Evidently this represents a state of equilibrium between complexed ligand and cyanide. The complexing agents, therefore, do not form metal complexes sufficiently stable to free enough cyanide ion to permit an analysis for the total cyanide ion concentration.
W80-01256

MICROBIOLOGICAL STUDIES ON THE QUALITY OF URBAN STORMWATER RUNOFF IN SOUTHERN ONTARIO, CANADA,
Ontario Ministry of the Environment, Rexdale (Ontario). Lab. Services Branch.
A. A. Qureshi, and B. J. Dutka.
Water Research, Vol 13, No 13, No 10, p 977-985, 1979. 5 Fig, 3 Tab, 18 Ref.

Descriptors: *Urban runoff, *Microorganisms, *Microbiology, *Canada, Bacteria, Pathogenic bacteria, Fungi, Indicators, Bioindicators, Coliforms, E. Coli, Streptococcus, Pseudomonas, Water quality, Sampling, On-site data collections, Data processing, Cities, Runoff, Storm runoff, *Ontario(Canada).

The microbiological quality of urban stormwater runoffs was investigated at three different locations in Southern Ontario, Canada. Microbial densities in these waters were similar to those found in dilute raw wastewaters and, therefore, they represent a potential health hazard. The recovery of pathogenic bacteria (Pseudomonas aeruginosa and salmonellae) furthe r substantiated the existence of health hazards. There appeared to be little relationship between the duration, intensity, and amount of rainfall and the occurrence of peak microbial populations. As a result, no typical pattern of time-related distribution of indicator and pathogenic bacteria could be established in this investigation. This suggests that 'initial flushing' has minimal effect on the microbiological quality of an individual storm event. Furthermore, the results indicated the seriousness of urban stormwater runoffs as a major factor in nonpoint source pollution of receiving waters and that it would be illogical to disinfect specific portions of these runoffs for removing health hazards as there was no predictable pattern of pathogen occurrence. (Sims-ISWS)
W80-01283

STATISTICAL ASSESSMENT OF INORGANIC NITROGEN IN A SMALL RIVER SYSTEM,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5C.
W80-01284

IMPACT OF WESTERN COAL MINING--I. CHEMICAL INVESTIGATIONS OF A SURFACE COAL MINE SEDIMENTATION POND,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 2K.
W80-01285

AN INVESTIGATION OF THE HEAVY METAL CONTENT OF THE WATER AND SEDIMENTS IN A RESERVOIR SUPPLYING DRINKING WATER TO A MAJOR MINING CENTER,
W. S. and L. B. Robinson Univ. Coll., Broken Hill (Australia).
A. J. Coggins, K. D. Tuckwell, and R. E. Byrne.
Environmental Science and Technology, Vol 13, No 10, p 1281-1285, October 1979. 3 Fig, 5 Tab, 25 Ref.

Descriptors: *Heavy metals, *Mining, *Reservoirs, *Sediments, *Australia, Sampling, Chemicals, Chemical analysis, Cadmium, Lead, Zinc, Copper, Manganese, Iron, Hydrogen ion concentration, Potable water, Water quality, Water supply.

Water and sediment samples were collected from a reservoir that supplies 30% of the domestic water use of a major lead-silver-zinc mining region. The samples were analyzed for cadmium, lead, zinc, and copper. Samples showed varying degrees of contamination by these elements, although measured levels in the water were below the World Health Organization limits for drinking water. Solution-sediment interactions in the catchment and reservoir were examined and showed a marked tendency for metals to be removed from solution into the underlying sediment. The relative effects of iron and manganese hydrous oxides, organic material, and clays on the distributions of each metal were examined. (Sims-ISWS)
W80-01292

NOTES ON MUDDY ODOUR. I SENSORY PROPERTIES AND ANALYSIS OF 2-METHYLISOBORNEOL IN WATER AND FISH,
Helsinki Univ., (Finland). Dept. of Limnology.
P. E. Persson, and R. K. York.
Aqua Fennica, Vol 8, p 83-88, 1978. 4 Fig, 10 Ref.

Descriptors: Freshwater fish, Pike, Bioassay, Laboratory tests, *Mud, Muddy odors, *Taste, *Taste producing algae, *2-methylisoborneol, Phytoplankton, Fish food, Public health, Helsinki, Finland, Winnipeg, Canada.

The muddy odour compound 2-methylisoborneol (MIB) was synthesized and its sensory properties were studied. In water, the odour threshold recognized by 75% of the judges varied in two independent experiments between 0.018-0.020 microg/l. The concentrations detected by a statistically significant percentage of the judges were 0.027=0.045 microg/l. In the flesh of pike (Esox lucius) the corresponding thresholds were 0.07 microg/l and 0.06 microg/l, respectively. In concentrations above 10 microg/l the musty or muddy odour of MIB is replaced by a camphorous smell. In the concentration range 0.01-10.0 microg/l the odour intensity as scored by the judges is proportional to the concentration, enabling the quantitation of MIB in water and fish by sensory methods. (See also W80-01317) (Katz-EIS)
W80-01316

NOTES ON MUDDY ODOUR. II UPTAKE OF 2-METHLISOBORNEOL BY RAINBOW TROUT (SALMO GAIRDNERI) IN CONTINUOUS FLOW AQUARIA,
Helsinki Univ. (Finland). Dept. of Limnology.
P. E. Persson, and R. K. York.
Aqua Fennica, Vol 8, p 89-90, 1978. 1 Tab, 11 Ref.

Descriptors: *Rainbow trout, Bioassay, Laboratory tests, Mud, *Muddy odors, Taste, Taste-producing algae, *2-methylisoborneol, Phytoplankton, Public health, Recreation, Fish food, Path of pollutants, Alimentary absorption.

Preliminary uptake experiments with rainbow trout (Salmo gairdneri) in continuous flow aquaria containing the muddy odour compound, 2-methylisoborneol, indicate the alimentary tract of the fish as an additional route of uptake of muddy odour, assuming importance when the fish are feeding . Muddy odour compounds dissolved in water also contribute to the tainting. (See also W80-01316) (Katz-EIS).
W80-01317

POLYCHLORINATED BIPHENYLS (PCB'S) IN PUGET SOUND: PHYSICAL/CHEMICAL ASPECTS AND BIOLOGICAL CONSEQUENCES,
Washington Univ., Seattle.
S. P. Pavlou, R. N. Dexter, and W. Hom.
In: The Use, Study and Management of Puget Sound, A Symposium, March 23-25, 1977, University of Washington, Seattle, p. 100-133, 1977. 5 Fig, 9 Tab, 48 Ref.

Descriptors: *Arochlor, *Polychlorinated biphenyls, Water pollution effects, *Path of pollutants, Sediments, Phytoplankton, Toxicity, Bioassays, *Puget sound, Seattle, Washington, Estuaries, Sediments, Chemical analysis, Chemical properties.

The physical and chemical aspects of PCB's in Puget Sound, especially the area near Seattle, Washington, and their biological consequences were explained in detail. A project was initiated to study the distribution of PCB in Puget Sound. The project included a baseline assessment of PCB in the major subregions of Puget Sound and laboratory investigations to evaluate their accumulation in marine phytoplankton and their toxicological impact to algal growth. The data collec ted suggest that accumulation on these various marine components, including biological uptake, is predominantly governed by equilibrium, partitioning of the chemicals between suspended phase and ambient water. (Katz-EIS).
W80-01318

AN ASSESSMENT OF THE EFFECTS OF SUBTIDAL SEWAGE OUTFALLS ON INTERTIDAL MACROFAUNA OF SEVERAL CENTRAL PUGET SOUND BEACHES,
Washington Univ., Seattle.
J. W. Armstrong, R. M. Thom, C. P. Staude, and K. K. Chew.
In: The Use, Study and Management of Puget Sound, A Symposium, March 23-25, 1977. University of Washington, Seattle, p. 177-199, 1977. 7 Fig, 7 Tab, 30 Ref.

Descriptors: *Animal populations, *Water pollution effects, Benthos, Intertidal, Animal groupings, Domestic wastes, Sewage, Washington, Seattle, *Puget sound, Statistical methods, Effluents, Effluent streams, Invertebrates.

A two year study of the intertidal macrofaunal communities at four beaches adjacent to the

sewage outfalls of the Municipality of Metropolitan Seattle, (Metro) and one control beach. An attempt was made to identify the existence of waste water related stresses. The study showed no measurable effects of waste water on the in tertidal macrofauna. The differences noted among the communities on each beach were positively correlated with differences in the suitable habitat on each beach. (Katz-EIS).
W80-01320

IMPACT OF SEWAGE ON BENTHIC MARINE FLORA OF THE SEATTLE AREA: PRELIMINARY RESULTS,
Washington Univ., Seattle.
R. M. Thom, J. W. Armstrong, C. P. Staude, and K. K. Chew.
In: The Use, Study and Management of Puget Sound, A Symposium, March 23-25, 1977, University of Washington, Seattle, p 200-220, 1977. 5 Fig,10 Tab, 18 Ref.

Descriptors: *Intertidal arlas, *Beaches, *Marine plants, *Water pollution effects, *Plant groupings, Domestic wastes, *Sewage, Washington, Seattle, *Puget sound, Statistical methods, Marine algae, Diatoms, Species diversity, Biomass.

The macro- and microflora of five Seattle beaches, four adjacent to submerged sewer outfalls and one control, were made for two years. The study was to provide baseline information regarding the intertidal algae of the Seattle area and to determine the effects of sewage on the intertidal flora. Minor differences were observed between the algal populations at the different beaches. The ability to quantify these differences was hampered by the variability inherent in most types of community analysis. No drastic effects were noted in the studies. (Katz-EIS)
W80-01321

EFFECTS OF PROLONGED EXPOSURE TO AMMONIA ON THE BLOOD AND LIVER GLYCOGEN OF COHO SALMON (ONCORHYNCUSH KISUTCH),
Municipality of Metropolitan Seattle, WA. Water Quality Lab.
J. A. Buckley, C. M. Whitmore, and B. D. Liming.
Comparative Biochemistry and Physiology, Vol 63C, p 297-303, 1979. 5 Tab, 59 Ref.

Descriptors: *Bioassay, *Toxicity, *Mortality, Nitrogen compounds, Water pollution effects, Laboratory tests, Salmon, *Coho salmon, Fish physiology, Biochemistry, Sewage effluents, Fish blood, Liver glycogen, *Ammonium compounds, Ammonium chloride, *Ammonia.

Duplicate groups (90 fish each) of hatchery-reared coho salmon were exposed for 91 days to either river water only (control), one of three concentrations of NH4Cl (3, 16, 47 mg N/l) in river water, or to 30% unchlorinated secondary-treated domestic sewage, all in continuous flow and unrecycled. Hemoglobin and hematocrit were reduced to levels indicative of anemia and the numbers of circulating immature erythrocytes increased. Mortalities were unrelated to concentrations of NH4Cl. Blood ammonia and urea concentrations were not significantly different after 91 days regardless of concentration of ambient ammonia. Plasma Na+ concentration increased, probably as a result of accelerated NH4+ excretion; and in some instances plasma K+ and Cl- concentrations changed. Blood glucose diminished, whereas liver glycogen stores increased; but these effects were significantly related only when glucose content was normal. (Katz-EIS)
W80-01322

ANALYSIS OF COMBINED EFFECT OF POLLUTANTS ON BIOLOGICAL SYSTEMS,
Moscow State Univ. (USSR).
V. N. Maksimov.
Hydrobiological Journal, Vol. 13, No. 4, p. 28-37, 1977. 3 fig, 5 tab, 6 ref.

Descriptors: *Water pollution effects, *Toxicity, Mortality, Bioassay, *Laboratory tests, *Methodology, Phytoplankton, Zooplankton, Analytical techniques, Zinc, Chromium, Oil, Oil spills, Dispersants, Mathematical studies, Desirability scale.

To elucidate the additivity or non-additivity of the effect of pollutants, specific interpretations of, data and their graphical representation are discussed To unambiguously define the nature of the effect of one or more pollutants, we support an approach involving the derivation of a generalized index incorporating all the 'particular' responses of the elements of a system, i.e., a scale of desirability Examples of analysis of experimental results by such a technique are given. Examples are given showing the effect of zinc and chromium salts on rotifer populations. Data are presented illustrating the effect of diesel oil, lubricating oil and one dispersant on phytoplankton species composition Computations using these data derive the desirability scale. (Katz-EIS)
W80-01323

SURVEY OF GAMMA-EMITTING ARTIFICIAL RADIONUCLIDES IN FISH FROM FINNISH WATERS,
Abo Akademi, Turku (Finland). Inst. of Biology.
B. Isomaa, and J. Dahlbacka.
Aqua Fennica, Vol. 8, p 78-82, 1978. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Radioisotopes, *Cesium, *Fish physiology, *Radioecology, Path of pollutants, Radiochemical analysis, Potassium, Trophic level, Gamma rays, Freshwater fish.

The levels of artificial gamma-emitting radionuclides in fish from certain Finnish waters have been studied using a Be(Li)-spectrometer. The only artificial radionuclide found in detectable amounts in fish muscle was 137Cs. An inverse relationship between the potassium concentration in the water and the levels of 137Cs in the fishes was found. In fishes from the same water higher concentrations of 137Cs were found in predatory fishes than in fishes feeding on plankton and benthos. (Deal-EIS).
W80-01325

FOOD INTAKE, GROWTH, FOOD CONVERSION, AND BODY COMPOSITION OF CATFISH EXPOSED TO DIFFERENT SALINITIES,
Bangalore Univ. (India). Dept. of Zoology
S. Arunachalam, and S. R. Reddy.
Aquaculture, Vol 16, p 163-171, 1979. 2 Fig, 4 Tab, 33 Ref.

Descriptors: *Salinity, *Catfishes, *Toxicity, Growth rates, Fish diets, Feeding rates, Fish physiology, Tubificids, Chemical analysis, Biomass, Productivity, Water chemistry, *Tissue Analysis.

The effects of different salinities (0, 2, 4, 6, and 10 o/oo) on food intake, growth, food conversion, and body composition of the freshwater catfish Mystus vittatus were studied. Under a restricted feeding schedule daily intake of food was found to be salinity dependent. Fish reared in 10 o/oo consumed more Tubifex tubifex, converted less efficiently and displayed poor growth as compared to individuals reared in fresh water. Fish flesh production decreased from 483 g (fresh water) to 177 g (10 o/oo salinity) as the salinity was increased. Water content of the fish was found to decrease with increase in salinity, while maximum ash (25.56%) and fat (42.25%) were exhibited by fish reared in 10 o/oo salinity. (Deal-EIS)
W80-01326

SEDATION OF WARM-WATER FISH SPECIES IN AQUACULTURE RESEARCH,
Stirling Univ. (Scotland) Unit of Aquatic Pathobiology.
L. T. Ross, and J. A. Geddes.
Aquaculture, Vol 16, p 183-186, 1979. 3 Tab, 2 Ref.

Descriptors: *Tilapia, *Toxicity, *Organic compounds, Fish physiology, Animal metabolism, Fish management, *Aquiculture, Respiration, Water temperature, Fry, *Benzocaine, *Anesthetics.

The technique of benzocaine sedation is outlined as a routine tool in aquaculture research. The effects of dose level and water temperature are demonstrated using 'Tilapia mariae'. Sensitivity to the agent varies according to species. Several general recommendations are made concerning the use of benzocaine for some species of tropical fish. (Deal-EIS)
W80-01327

THE EFFECTS OF TEMPERATURE ON THE RESPIRATION AND PRODUCTION OF THE FRESHWATER NEMATODE ANONCHUS SP.,
Lancaster Univ., Bailrigg (England). Dept. of Biological Sciences.
J. Laybourn.
Oecologia, Vol. 41, p. 329-337, 1979. 4 fig, 3 tab, 24 ref.

Descriptors: *Nematodes, *Growth rates, *Water temperature, Respiration, Animal metabolism, Animal physiology, Productivity, Oxygen requirements, Toxicity, Invertebrates, Weight, *Anonchus.

Growth and respiration were measured in a species of Anonchus at 5C, 10C, 15C, 20C and 25C. At 5C no growth was measurable but the organisms remained active. Maximum production occurred at 15C, but the highest rate of growth occured at 20C. Thus, adult size attained is dependent on the temperature of growth. Respiratory energy losses derived from Cartesian diver microrespirometry, increased with temperature up to 25C. Regression coefficients (b values) derived from a log linear regression of weight against oxygen consumption varied between 0.574-1.793, the lowest value being attained at 5C, the highest at 20C. Based on Q10, production and respiratory energy losses the optimum temperatures for Anonchus appears to lie between 10C-15C. (Deal-EIS)
W80-01328

PHYSIOLOGICAL BASIS OF DIFFERENTIAL SENSITIVITY OF FISH EMBRYONIC STAGES TO OIL POLLUTION,
Texas A and M Univ., College Station. Dept. of Biology.
J. R. Sharp, K. W. Fucik, and J. M. Neff.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 85-108, 1979. 9 Fig, 32 Ref.

Descriptors: *Oil, *Toxicity, *Killifishes, *Growth stages, Embryonic growth stage, Larval growth stage, Bioassay, Mode of action, Growth rates, Fish physiology, Animal metabolism, Mortality, *Naphthalenes, *Bioaccumulation.

The embryo-larval stages of the estuarine killifish Fundulus heteroclitus were moderately tolerant to the water-soluble fraction of a no. 2 fuel oil, showing an LC50 of approximately 1.5 ppm total hydrocarbons. The early embryonic stages were somewhat more sensitive to the 25% WSF than were later embryonic and larval stages. The heart beat rate of 9-11 day old embryos was significantly depressed only by WSF exposure regimes which also resulted in significant decreases in hatching success. Oxygen consumption of 10-day old embryos was slightly depressed by highly stressful exposure regimes and stimulated slightly by mildly stressful exposure regimes. Metabolic scope and energy reserves of fish embryos are small. When stressed by exposure to oil, limited metabolic energy is shunted away from critical differentiation and morphogenic processes to maintenance functions. The depressant effects of hydrocarbon stress early in development may be reflected in later embryonic stages by depressed development rate, hatching success and survival of emergent larvae and increased incidence of development anomalies. (Deal-EIS)
W80-01332

TOXIC CATIONS AND MARINE BIOTA: ANALYSIS OF RESEARCH EFFORT DURING THE THREE-YEAR PERIOD 1974-1976,
Environmental Research Lab., Narragansett, RI.

R. Eisler.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 111-149, 1979. 3 Tab, 1 Append, 236 Ref.

Descriptors: *Toxicity, *Aquatic life, *Cations, Heavy metals, Metals, Bioindicators, Methodology, *Zinc, *Mercury, *Copper, *Cadmium, *Lead, *Iron, *Manganese, Bioassay, Water pollution effects, Mollusks, Marine fish, Crustaceans, Marine algae, Marine animals, Annelids, Absorption, Path of pollutants, *Silver, *Arsenic.

Available technical articles published during 1974, 1975, and 1976 on effects of heavy metals and toxic cations upon estuarine and marine flora and fauna were reviewed. For all articles, research effort generated by toxicant, by response parameter, and by major indicator organism assemblage was tabulated for field investigations and for laboratory studies. Most of the effort during this period was restricted to 6 metals (Zn, Hg, Cu, Cd, Pb) and 4 indicator groups (molluscs, teleosts, crustaceans, algae). Laboratory investigators devoted a major portion of their workload to uptake, retention, and translocation studies, followed by studies on survival, on growth and development, reproduction, food chain transfer, behavior, respiration, body fluid chemistry, histology, and others, in that sequence. Results of field studies were confined almost exclusively to acquisition of data on baseline elemental composition and accompanying biotic and abiotic modifiers. Apparent limitations and deficiencies of current projects on biological effects assessment of metals and toxic cations in marine environments were presented and discussed. Suggestions were offered on direction and emphasis of future research in this subject area. (Deal-EIS)
W80-01333

THE USE OF BIVALVE MOLLUSCS IN HEAVY METAL POLLUTION RESEARCH,
North Carolina Central Univ., Durham. Dept. of Biology.
P. A. Cunningham.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 184-221, 1979. 1 Fig, 1 Tab, 103 Ref.

Descriptors: *Heavy metals, *Bioassay, *Mollusks, Bioindicators, Chemical properties, Absorption, Animal metabolism, Animal physiology, Path of pollutants, Growth stages, Animal behavior, Toxicity, Mortality, Mode of action, Analytical techniques, Reproduction, Water temperature, Salinity, Seasonal, Methodology, *Bioaccumulation, *Tissue analysis.

A summary of heavy metal research utilizing bivalve molluscs has been presented. In the past 5 years, use of new techniques has increased our understanding of the kinetics of metal uptake, tissue distribution, and release, but not all metals have been equally well studied. To further improve our understanding, genetically similar individuals with comparable histories need to be studied using the most sensitive analytical techniques available (i.e., electron microscopy coupled with microprobe analysis). Several areas in which knowledge of the toxicological effects of various metals could be expanded include: population effects, organism effects, organ and tissue effects and cellular and subcellular effects. Specific recommendations for further study are made in each of these research areas. (Deal-EIS)
W80-01336

A BENTHIC BIOASSAY USING TIME-LAPSE PHOTOGRAPHY TO MEASURE THE EFFECT OF TOXICANTS ON THE FEEDING BEHAVIOR OF LUGWORMS (POLYCHAETA: ARENICOLIDAE),
University of West Florida, Pensacola. Faculty of Biology.
N. I. Rubinstein.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 341-351, 1979. 4 Fig, 15 Ref.

Descriptors: *Pesticide toxicity, *Worms, *Bioassay, Benthic fauna, Food habits, Food chains, Animal behavior, Mode of action, Analytical techniques, Photography, Feeding rates, Insecticides, Chlorinated hydrocarbon pesticides, *Polychaetes, *Kepone, *Arenicola.

A benthic bioassay was developed to elucidate the effect of pollutants on the substrate reworking activity of an infaunal polychaete (Arenicola cristata). Lugworms exposed to the pesticide Kepone (at water concentrations as low as 2.8 microg/l) showed a significant reduction in sediment processing activity when compared with non-exposed animals. Reduction of substrate reworking activity by lugworms and other organisms with similar deposit feeding habits could affect sediment-water column dynamics and ultimately alter benthic food chains. Toxicity tests using sub-lethal responses to pollutants provide a sensitive and realistic way to evaluate the ecological impact of pollutants on the benthic component of the marine environment. (Deal-EIS)
W80-01341

DISTRIBUTION OF HYDROCARBONS AMONG OIL, WATER AND VAPOR PHASES DURING OIL DISPERSANT TOXICITY TESTS,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
A. Bobra, D. Mackay, and W. Y. Shiu.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 558-565, 1979. 2 Tab, 1 App, 8 Ref.

Descriptors: *Mathematical models, *Bioassays, *Oil spills, Toxicity, Oil, Chemical properties, Chemical reactions, Gases, Oil-water interfaces, Detergents, Organic compounds, Solubility, *Dispersants.

The problem is addressed of calculating the distribution of specific hydrocarbons between the oil phase (slick or dispersed), the aqueous phase and the vapor phase during a toxicity test. It is suggested that this calculation is an essential component of interpreting the toxicity observations since, in many cases, the exposure of the organism to hydrocarbons depends on the relative volumes of these three phases. A set of equations have been derived which permit the calculation of the partition of a hydrocarbon or group of hydrocarbons between oil, water and vapor phases. Their value in toxicity testing is discussed. (Deal-EIS)
W80-01346

SOURCE ASSESSMENT: PLASTICS PROCESSING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
T. W. Hughes, R. F. Boland, and G. M. Rinaldi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 926, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-78-004c, March 1978. 90 p, 18 Fig, 12 Tab, 61 Ref, 1 Append. 68-02-1874.

Descriptors: *Air pollution, *Plastics, *Industrial wastes, *Organic compounds, Water pollution sources, Industrial plants, Industrial production, Water pollution control, Water quality, Water quality standards, Industries, Pollutant identification.

The enivronmental impact of atmospheric emissions from plants that manufacture marketable products by means of plastics processing is evaluated, and the composition, quantity and rate of emissions for specific sources are reviewed. If no additional implementation of existing control technologies occurs, plastics processing will generate 54 percent greater mass emissions in 1981 than in 1976; these industries presently contribute 2.8 percent of national hydrocarbon emission and 0.12 percent of national particulate emissions. State-to-state ranges of these emissions are 0.04-8.96 percent for hydrocarbons and 0.00-2.59 percent for particulates. Secondary sources of information rather than new data were used for this state-of-art study. Included are: (1) An overiew of the industry, including process operations for 16 dinds of plastics, emission factors for different handling methods and operations, and source severities for criteria pollutants from 16 hypothetical but statistically typical plants representing each kind of plastic; (2) A description of raw materials and production processes, along with a geographic distribution of plant sites and plastic consumption; (3) An inventory of amounts and effects of uncontrolled atmospheric emissions from the 16 statistically typical processing plants; (4) A review of potentially appliable control technologyies; (5) An analysis of consumption trends which affect the future volume of plastic manufacturing. (Harris-Wisconsin)
W80-01372

SOURCE ASSESSMENT: RUBBER PROCESSING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
C. T. Chi, T. W. Hughes, T. E. Ctvrtnicek, D. A. Horn, and R. W. Serth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 423, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-78-004j, March 1978. 118 p 18 Fig, 46 Tab, 39 Ref, 2 Append. 68-02-1874.

Descriptors: *Air pollution, *Rubber, *Industrial wastes, *Organic compounds, Synthetic rubber, Water pollution sources, Industrial production, Water pollution control, New Hampshire, Ohio, California, Water quality, Water quality standards, Industries, Pollutant identification.

The environmental impact of atmospheric emissions from rubber processing industries is assessed, and the composition, quantity and rate of emissions for specific sources are reviewed. Mass emissions from approximately 1,700 rubber processing plants in 43 states constitute 0.26 percent of national hydrocarbon emissions and 0.074 percent of national particulate emissions. About a fourth of these plants are located in Ohio and California and another fourth in Illinois, New York, New Jersey and Massachusetts. Only New Hampshire has emissions of at least one criteria pollutant from rubber processing which exceeds one percent of the state total emissions of that pollutants. Included are: (1) A detailed description of emission sources, comprising a general industry overview, a geography of rubber manufacturing plants, and an outline of industry production processes; (2) A discussion of specific kinds of emissions from processing plants; (3) An inventory of emission factors and associated environmental effects; (4) A description of present and future aspects of control technology; (5) Projectd industry growth and anticipated technological developments. Secondary sources of information (scientific literature and government data inventories) rather than new data were used for this state-of-the-art study. (Harris-Wisconsin)
W80-01373

OCEAN OUTFALL WASTEWATER DISPOSAL FEASIBILITY AND PLANNING.
North Carolina State Univ. at Raleigh, NC; and East Carolina Univ., Greenville, NC.; and North Carolina at Chapel Hill.
For primary bibliographic entry see Field 5E.
W80-01402

WATER QUALITY MONITORING DATA FOR GEORGIA STREAMS - 1977,
Georgia Dept. of Natural Resources, Atlanta. Environmental Protection Div.
January 1978. 315 p, 5 Fig, 113 Tab, 4 Ref.

Descriptors: *Measurement, *Stream gages, *Water measurement, *Streams, *Water quality, *Water analysis, *Baseline studies, *Monitoring, *River basins, *Georgia, Gaging stations, Streamflow, Freshwater, Pollutants, Sediment load, Biochemical oxygen demand, Chemical oxygen demand, Dissolved oxygen, Bioindicators, Coliforms, Runoff, Conductivity, Nutrient load, Diversity index.

This report compiles monitoring data for 113 sites across the State of Georgia for the year 1977. An

eight digit number was used to indicate the exact site of the stream monitoring gage, with the first two digits denoting one of the 15 major basins of the state being studied. These river systems are the Savannah, Ogeechee, Oconee, Upper Ocmulgee, Lower Ocmulgee, Altamaha, Satilla, St. Mary, Suwannee, Chloocknee, Flint, Chattahoochee, Tallapoosa, Coosa, and Tennessee. Chemical analyses at monitoring points yielded minimum values for such agents as dissolved oxygen (DO), pH, nitrates and nitrites, light and heavy metals, biochemical oxygen demand (BOD), chemical oxygen demand (COD); and a determination of heavy and light metal and content of certain toxins in stream sediment. An organism 'diversity index' was compiled as part of the biological analysis of the streams, and various size filters and sieves were used to capture and categorize organisms. Categories established were macro-invertebrate organisms (though small enough to be capturable in a no. 30 mesh sieve), periphyton, plankton, and macrophyton. Stream quality was found to be generally quite high and toxic and sediment load low in the mountain streams of Northern Georgia and in the freshwater swamp streams of Southeastern Georgia, while tubridity, pollution and sediment loads were significantly higher in the more populous central part of the state. (Arnold-NC)
W80-01410

WATER QUALITY INVESTIGATION OF ESTUARIES OF GEORGIA - 1977,
Brunswick Junior Coll., GA.
Prepared for Georgia Department of Natural Resources, Environmental Protection Division, Atlanta, Annual Report, January 1978. 166 p, 5 Fig, 48 Tab, 37 Ref, 1 Append.

Descriptors: *Streams, *Measurement, *Stream gages, *Water measurement, *Estuaries, *Rivers, *Water quality, *Baseline studies, Water pollution, *Georgia, Gaging stations, Freshwater, Bioindicators, Fouling plates, Coliforms, Phosphates, Nutrients, Biochemical oxygen demand, Chemical oxygen demand, Dissolved oxygen.

This report compiles monitoring data from 11 stations in estuarine areas of the six coastal counties of the State of Georgia. Chemical, biological and physical analyses were conducted, and a 'diversity index' of biological organisms was compiled. Biological oxygen demand (BOD) was found to vary between 1.2 and 3.1 mg/l, a little higher than 1975 readings. Dissolved oxygen levels varied, but were found to correlate positively with existing chloride concentration, particularly at Brunswick Harbor. DO concentration averaged between 5.6 and 7.4 mg/l for the estuaries. Average color was found to have darkened since 1975, and average turbidity is increasing markedly in these waters. Phosphate load was found to be relatively low although fecal coliform counts were much greater than in 1976. Plexiglas 'fouling plates' were set out regularly at the 11 stations to collect samples of small stream organisms. The Altamaha and Ogeechee River areas had the lowest diversity of such organisms, in contrast to 1976, when they had nearly the greatest diversity. Average organism density and diversity were found to be much higher in summer than in winter. Dominant collected organisms were hydroids, barnacles, ectoprocts, and tube building amphipods.
W80-01411

ALGAL ASSAY AND CHEMICAL ANALYSIS: A COMPARATIVE STUDY OF WATER QUALITY ASSESSMENT TECHNIQUES IN A POLLUTED RIVER,
Illinois State Univ., Normal. Dept. of Biological Sciences.
J. R. Cain, R. L. Klotz, F. R. Trainor, and R. Costello.
Environmental Pollution, Vol 13, p 215-224, 1979. 1 Fig, 4 Tab, 17 Ref. OWRT A-052-CONN (20), 14-31-0001-3807.

Descriptors: *Water quality, *Water analysis, *Analytical techniques, Methodology baseline studies, Bioassay, Chemical analysis, Nutrients, Aquatic algae, Biomass, Growth rates, Water quality control, Phosphates, Nitrates.

The water quality of a polluted river was monitored for a two-year period by use of an algal bioassay and routine chemial analyses. Comparison of six sampling sites using t-tests for paired data for each parameter measured shows that the algal assay is as efficient as all chemical analyses in differentiating between sites. Comparison of the algal assay with each chemical parameter by means of correlation coefficients shows greatest correlation between the assay and orthophosphate. The benefits of using algal assays alone or in addition to chemical analyses are discussed. (Deal-EIS)
W80-01541

EFFECTS OF SOLAR RADIATION ON THE DYNAMICS OF DISSOLVED OXYGEN IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures
For primary bibliographic entry see Field 8I.
W80-01583

5B. Sources Of Pollution

ORIGIN AND VARIATION OF NITRATE NITROGEN IN THE CHALK SPRINGS, STREAMS, AND RIVERS IN DORSET AND ITS UTILIZATION BY HIGHER PLANTS,
Freshwater Biological Association, Wareham (England), River Lab.
For primary bibliographic entry see Field 5C.
W80-01276

MICROBIOLOGICAL STUDIES ON THE QUALITY OF URBAN STORMWATER RUNOFF IN SOUTHERN ONTARIO, CANADA,
Ontario Ministry of the Environment, Rexdale (Ontario). Lab. Services Branch.
For primary bibliographic entry see Field 5A.
W80-01283

A SQUARE GRID TRANSPORT MODEL RELATING LAND USE EXPORTS TO NUTRIENT LOADS IN RIVERS,
Institute National de la Recherche Scientifique, Rimouski (Quebec).
D. A. Cluis, D. Couillard, and L. Potvin.
Water Resources Research, Vol 15, No 3, p 630-636, June 1979. 3 Fig, 5 Tab, 12 Ref.

Descriptors: *Water quality, *Rivers, *Land use, *Model studies, *Canada, Watersheds(Basins), Analysis, Analytical techniques, Nutrients, Mathematical models, Nitrogen, Phosphorus, Water pollution sources, Agricultural runoff, *Yamaska River, Nutrient transport model, Stream loading, Nonpoint pollution sources.

This transport model relates a nutrient-oriented land use data bank to mass discharges of total nitrogen and total phosphorus on an annual or seasonal basis. This bank is based upon already available Canadian statistics distributed upon drainage units of the Universal Transverse Mercator square grid system; it contains information on the intensities and spatial distributions of the produced loads for both types of sources (direct and diffuse). Using two constants only, the contribution of a drainage unit to a downstream site can be written as L = (C sub T to the K power) (P + (C b I x NP)), where P and NP represent the point and nonpoint production of nutrients; C sub I is an internal transfer coefficient of nonpoint sources to the river; C sub T is a transport coefficient from one unit to the following unit; and K is a distance expressed in number of units covered. Stable sets of coefficients were obtained for each season, reflecting the hydrological regime and differences in mobility of phosphorus and nitrogen. Once it is calibrated, the model can be used to assess the relative contributions of each type of land use and to predict the effect of impoundments or changes in land use. (Humphreys-ISWS)
W80-01286

AN INVESTIGATION OF THE HEAVY METAL CONTENT OF THE WATER AND SEDIMENTS IN A RESERVOIR SUPPLYING DRINKING WATER TO A MAJOR MINING CENTER,
W. S. and L. B. Robinson Univ. Coll., Broken Hill (Australia).
For primary bibliographic entry see Field 5A.
W80-01292

NOTES ON MUDDY ODOUR. II UPTAKE OF 2-METHLISOBORNEOL BY RAINBOW TROUT (SALMO GAIRDNERI) IN CONTINUOUS FLOW AQUARIA,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5A.
W80-01317

POLYCHLORINATED BIPHENYLS (PCB'S) IN PUGET SOUND: PHYSICAL/CHEMICAL ASPECTS AND BIOLOGICAL CONSEQUENCES,
Washington Univ., Seattle.
For primary bibliographic entry see Field 5A.
W80-01318

DETOXIFICATION SYSTEM IN POLYCHAETE WORMS: IMPORTANCE IN THE DEGRADATION OF SEDIMENT HYDROCARBONS,
Skidway Inst. of Oceanography, Savannah, GA.
R. F. Lee, S. C. Singer, K. R. Tenore, W. S. Gardner, and R. M. Philpot.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J Vernberg, Eds., Academic Press, New York, p 23-37, 1979. 5 Fig, 2 Tab, 34 Ref.

Descriptors: *Invertebrates, *Oil, *Animal metabolism, Enzymes, Biochemistry, Chemical reactions, Biodegradation, Genetics, Adaptation, Organic compounds, Microbial degradation, Bottom sediments, Benthic fauna, *Polychaetes, *Nereis, *Capitella.

The polychaetes, Nereis virens and Capitella capitata, have a mixed function oxygenase (MFO) system which metabolizes polycyclic aromatic hydrocarbons. In Nereis virens this enzyme system was associated with microsomes of the lower intestine. Similarities between the MFO of polychaetes and other animals, both vertebrate and invertebrate, were noted with respect to cytochrome P-450 and phospholipid components, cofactor requirements, effect of inhibitors, pH optima and temperature optima. MFO activity was found in Capitella capitata only after exposure to either petroleum or its components with worms, primarily of the third generation, having higher MFO activity than the first or second generation of worms exposed to petroleum. Selection of a genotype with increased MFO activity was suggested. Polychaetes were important in degradation of crude oil both by directly degrading hydrocarbons and indirectly by turning over sediments during feeding, thus allowing petroleum-degrading microbes to metabolize subsurface hydrocarbons. (Deal-EIS)
W80-01330

CONDITION INDEX AND FREE AMINO ACID CONTENT OF MACOMA INQUINATA EXPOSED TO OIL-CONTAMINATED MARINE SEDIMENTS,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
G. Roesijadi, and J. W. Anderson.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J Vanberg, Eds., Academic Press, New York, p 69-83, 1979. 1 Fig, 5 Tab, 28 Ref

Descriptors: *Clams, *Oil, *Toxicity, Amino acids, Biochemistry, Path of pollutants, Bottom sediments, Oil pollution, Bioindicators, Chemical analysis, Mode of action, Mortality, Animal behavior, Animal metabolism, *Macoma, *Tissue analysis

Stress in Macoma inquinata exposed to oil-contaminated sediment was evident at 3 levels of examination. These were reduced survival, reduced condition index, and reduced levels of free amino acids, primarily glycine, with concomitant eleva-

tions in the taurine:glycine ratio. This study has provided evidence that free amino acid content, as well as condition index, may be useful indicators of physiological stress in marine bivalves exposed to petroleum. These parameters may also be useful as general indicators of pollutant stress in bivalves and, possibly, other marine organisms. (Deal-EIS)
W80-01331

TOXIC CATIONS AND MARINE BIOTA: ANALYSIS OF RESEARCH EFFORT DURING THE THREE-YEAR PERIOD 1974-1976,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W80-01333

HEMATOLOGICAL EFFECTS OF LONG-TERM MERCURY EXPOSURE AND SUBSEQUENT PERIODS OF RECOVERY ON THE WINTER FLOUNDER, PSEUDOPLEURONECTES AMERICANUS,
National Marine Fisheries Service, Milford, CT. Northeast Fisheries Center.
M. A. Dawson.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 171-182, 1979. 2 Tab, 21 Ref.

Descriptors: *Mercury, *Toxicity, *Fish physiology, Biochemistry, Heavy metals, Proteins, Calcium, Sodium, Potassium, Animal metabolism, Bioassay, Mode of action, Chlorides, *Flounder, *Pseudopleuronectes, *Hematology, *Tissue analysis, *Hemoglobin.

Winter flounder were exposed to 10- and 20-ppb mercury as the chloride for 60 days and subsequently allowed to recover for 15 or 60 days in clean seawater in order to determine mercury effects and the rate and extent of recovery as measured by a variety of hematological tests. Following the 60-day exposure period, the hemoglobin, hematocrit, erythrocyte count (RBC), and mean corpuscular hemoglobin count (MCHC) decreased in exposed fish. Mean corpuscular volume (MCV) increased in exposed animals. The 15-day recovery period brought about virtually no recovery of the red-cell component of the blood. After the 60-day recovery period, animals exposed to 20-ppb mercury returned to the control levels in hemoglobin and RBC; MCV remained at its previous elevated level. Fish exposed to 10-ppb mercury returned to control levels in all these variables. Plasma sodium concentration rose in both exposure groups following the 15-day recovery period. After the 60-day recovery, the values were highly variable and not significantly different from controls. Plasma calcium concentrations dropped in exposed fish, returning to control values after 15 days of recovery. (Deal-EIS)
W80-01335

PRELIMINARY OBSERVATIONS ON THE CYTOPATHOLOGICAL EFFECTS OF COPPER SULFATE ON THE CHEMORECEPTORS OF CALLINECTES SAPIDUS,
National Marine Fisheries Service, Oxford, MD. Northeast Fisheries Center.
J. E. Bodammer.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 223-237, 1979. 9 Fig, 24 Ref.

Descriptors: *Toxicity, *Crabs, *Copper sulfate, Cytological studies, Animal pathology, Animal physiology, Mode of action, Crustaceans, Heavy metals, Sulfates, Copper, Copper compounds, *Tissue analysis.

The present investigation indicates that copper may have a necrotizing effect on the dendrites of blue crab chemoreceptors. At 1000 microg/l, copper sulfate solutions completely disrupt the integrity and disposition of the dendrites within all the sensilla that were examined. In this instance, the damage sustained by the receptor cells is extensive and suggests that they are probably nonfunctional. It is not known at the present time whether the observed lesions resulted directly from an interaction between the toxicant and receptor cell processes, or whether they occurred as a result of otheralterations in homeostasis. At lesser concentrations (100 and 50 microg/l) the effects of copper sulfate on the receptor cell dendrites are less intense and variable between aesthetascs in the 100 microg/l group, while the vast majority of sensilla from the 50 microg/l test appear 'normal'. (Deal-EIS)
W80-01337

COPPER AND CADMIUM INDUCED CHANGES IN THE METABOLISM AND STRUCTURE OF MOLLUSCAN GILL TISSUE,
National Marine Fisheries Service, Beaufort, NC. Southeast Fisheries Center.
D. W. Engel, and B. A. Fowler.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 239-256, 1979. 9 Fig, 26 Ref.

Descriptors: *Copper, *Cadmium, *Toxicity, *Oysters, Animal physiology, Animal metabolism, Heavy metals, Mode of action, Oxygen requirements, Biochemistry, Proteins, Chemical analysis, Electron microscopy, Mollusks, Path of pollutants, Respiration, *Bioaccumulation, *Tissue analysis, *Crassostrea, *Gills.

Experiments were conducted to determine the physiological and cellular effects of accumulated copper and cadmium on the gill tissue of Eastern oyster, Crassostrea virginica, as a measure of damage to the whole animal. The oysters were exposed to either 50 or 100 ppb copper, or 100 or 600 ppb cadmium continuously for up to 14 days. The gill tissue from exposed oysters accumulated both copper and cadmium as a function of time of exposure. Copper caused significant increases in the rate of oxygen consumption only in the 100 ppb exposure group and 600 ppb cadmium also caused similar changes, but the data were more variable. Comparisons of the fine structures of gill tissue from oysters exposed to either 100 ppb copper or 100 ppb cadmium for 14 days showed that only copper caused intracellular alterations. Exposure to 100 ppb cadmium, however, caused the induction of a cadmium-binding, low-molcular weight protein. (Deal-EIS)
W80-01338

FATTY ACID COMPOSITION OF PHOSPHOLIPIDS IN THERMALLY ACCLIMATING SCULPINS (LEPTOCOTTUS ARMATUS) TREATED WITH POLYCHOLRINATED BIPHENYLS (AROCLOR 1254),
Oregon State Univ., Newport. Dept. of Fisheries and Wildlife.
R. S. Caldwell, E. M. Caldarone, and B. A. Rosene.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 271-290, 1979. 4 Fig, 1 Tab, 31 Ref.

Descriptors: *Aroclors, *Toxicity, *Lipids, Polychlorinated biphenyls, Water temperature, Mode of action, Adaptation, Biochemistry, Animal metabolism, Fish physiology, Chemical analysis, Organic acids, *Leptocottus, *Sculpins, *Tissue analysis.

Treatment of juvenile sculpins (Leptocottus armatus) with a sublethal dose of the polychlorinated biphenyls (PCB's) mixture, Aroclor 1254, resulted in a modification of the pattern of fatty acids in whole body phospholipids during 12 days of acclimation to either 7 or 19.2 C compared to ethanol injected controls. At both acclimation temperatures, the phospholipids of the PCB treated fish, compared to controls, contained more saturated fatty acids and the magnitude of the change in saturation level at both temperatures was comparable to the differences seen between cold (7 C) and warm (20 C) acclimated fish not treated with PCB's. Based on the observed effects due to PCB treatment in this study and the observed and known adaptive responses of fatty acid composition associated with temperature acclimation of poikilotherms, it is suggested that the Aroclor treated fish may be functionally adapted to a temperature approximately 13 C higher than their acclimation temperature. The observed effects on the fatty acid composition of the phospholipids of PCB treated fish is interpreted in the context of effects of the pollutant on the microsomal fatty acid desaturating system of vertebrates. (Deal-EIS)
W80-01339

PHYSIOLOGICAL AND BIOCHEMICAL INVESTIGATIONS OF THE TOXICITY OF PENTACHLOROPHENOL TO CRUSTACEANS,
University of West Florida, Pensacola. Faculty of Biology.
K. R. Rao, F. R. Fox, P. J. Conklin, A. C. Cantelmo, and A. C. Brannon.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 307-339, 1979. 16 Fig, 1 Tab, 66 Ref.

Descriptors: *Pesticide toxicity, *Crustaceans, *Growth stages, Shrimp, Crabs, Sodium compounds, Mode of action, Mortality, Animal physiology, Animal metabolism, Biochemistry, Enzymes, Inhibition, Bioassay, Larval growth stage, Chemical properties, Proteins, Carbohydrates, Lipids, *Pentachlorophenol(PCP), *2-4-dinitrophenol(DNP), *Tissue analysis.

The toxicity of sodium pentachlorophenate (Na-PCP) to the grass shrimp, Palaemonetes pugio, varied with the stage in the molt cycle. In both short-term (96 hr bioassay) and long-term (66 days) studies newly molted shrimp exhibited the greatest sensitivity to Na-PCP. Crustaceans are capable of regenerating lost limbs. The effects of Na-PCP on oxygen consumption varied depending on the stage of the molt cycle and the concentration of Na-PCP. Tests on isolated tissues (muscle, gill and hepatopancreas) from the blue crab, Callinectes sapidu, revealed that Na-PCP and 2,4-dinitrophenol (DNP) inhibit oxygen consumption in vitro. Na-PCP and DNP had inhibitory effects on several hepatopancreatic enzymes in blue crabs. The present studies on crustaceans and the previous studies on fish, molluscs and rats seem to indicate that PCP affects carbohydrate metabolism, lipid metabolism, ion transport and possibly protein metabolism. The inhibitory effects on a wide variety of enzymes suggest that the actions may be due to non-specific interactions of this phenol with membrane proteins. (Deal-EIS)
W80-01340

BEYOND THE LC50: AN OPINION ABOUT RESEARCH ACTIVITIES AND NEEDS CONCERNING PHYSIOLOGICAL EFFECTS OF POLLUTANTS IN THE ENVIRONMENT,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
C. J. Sindermann.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 437-450, 1979. 19 Ref.

Descriptors: *Bioassay, *Analytical techniques, *Monitoring, Methodology, Animal physiology, Mode of action, Laboratory tests, Organic compounds, Heavy metals, Oil, Water pollution effects, Animal metabolism, Biochemistry, Toxicity.

Physiological studies of pollutants in the coastal/estuarine environment--heavy metals, petroleum components, and halogenated hydrocarbons--have provided much information about effects on the biota. Data from laboratory experiments; combined with field observations and results of field experiments, reduce intuitive conclusions and expand areas of genuine understanding. There is still, however, a large area of uncertainty about multiple pollutant effects on marine organisms, and the critical problem of resistance to contaminant toxicity is only now beginning to be elucidated. A satisfying shift of emphasis toward understanding sublethal effects of long-term exposure to contaminants and away from artificial short-term acute exposures has taken place. Additionally, greater attention has been focused on metabolic pathways,

induction of resistance mechanisms, and possibilities for monitoring using physiological/biochemical criteria. (Deal-EIS)
W80-01345

DISTRIBUTION OF HYDROCARBONS AMONG OIL, WATER AND VAPOR PHASES DURING OIL DISPERSANT TOXICITY TESTS,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5A.
W80-01346

POLLUTANS LOADINGS IN URBAN STORM WATER,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
P. V. Roberts, L. Dauber, B. Novak, and J. Zobrist.
Progress in Water Technology, Vol 8, No 6 p 93-101, 1977. 2 Fig, 3 Tab, 13 Ref.

Descriptors: *Urban runoff, *Storm runoff, *Water pollution control, *Surface runoff, *Sewage treatment, *Separated sewers, Storm water, Pollutants, Sewage, Sewage effluents, Switzerland, Waste water disposal, Combined sewers, Sewage disposal, Water pollution treatment, Sewerage, Wate pollution sources.

One solution to pollution caused by combined runoff and sanitary sewage systems is to divert relatively unpolluted storm water from sanitary sewer systems and discharge it without treatment Storm water pollutant in a section of Zurich, Switzerland, is equivalent to secondary effluent, except for high concentrations of suspended solids, and these are relatively inorganic compared to sewerage solids and do not contain large amounts of pollutants. Several advantages to separate systems are noted: reduced treatment plant disturbances from hydraulic shock loads; higher wastewater temperatures in wnter; and reduced pollutional load in combined sewer overflows. These tnetative conclusions were made after six months of measuring pollutant load in runoff from a well-defined residential area with complete separation of storm and sanitary sewer systems. The study area had light traffic, regular street cleaning, flat topography, and 100 people/hectare. The 1975 study recorded 409 mm precipitation totaling 12,200 cu m of runoff with 70% of the volume sufficient for water sample chemical analyses. Annual per-capital load was greater for biologically treated municipal sewage effluent than storm water for all pollutants. Most countries combine runoff and sanitary sewage. The plants normally treat twice the peak dry weather flow and allow the excess to overflow during wet weather. This seriously contributes to water pollution. (Danovich-Wisconsin)
W80-01364

GROWTH RESPONSE OF ANABAENA FLOS-AQUAE (LYNGB.) DEBREBISSON IN WATERS COLLECTED FROM LONG LAE RESERVOIR, WASHINGTON,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5C.
W80-01369

USE OF ALGAL ASSAYS TO ASSESS THE EFFECTS OF MUNICIPAL AND SMELTER WASTES UPON PHYTOPLANKTON PRODUCTION,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5C.
W80-01370

SOURCE ASSESSMENT: PLASTICS PROCESSING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
For primary bibliographic entry see Field 5A.
W80-01372

SOURCE ASSESSMENT: RUBBER PROCESSING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
For primary bibliographic entry see Field 5A.
W80-01373

WATER QUALITY OF AQUIFERS AS AFFECTD BY MOVEMENT OF FERTILIZER NUTRIENTS UNDER IRRIGATION,
Minnesota Univ., St. Paul. Dept. of Soil Science.
A. C. Caldwell, and G. C. Buzicky.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116585, Price codes: A02 in paper copy, A01 in microfiche. Report Water Resources Research Center, University of Minnesota 1979. 9 p. OWRT A-034-MINN (2).

Descriptors: *Aquifers, *Irrigation, *Nutrients, *Fertilizers, Sulfur, Path pollutants.

A field experiment was established on a Sverdrup sandy loam in Central Minnesota to evaluate the effects of amounts and timing of nitrogen (N) fertilizer applications on N uptake by irrigated corn (Zea mays L), and the movement of N into the aquifer 4.5 m below the soil surface. Nitrogen was applied as urea at rates of 179 and 269 kg N/ha in one application at planting or in split applications through the season. (Blake-Minn)
W80-01376

HYDROLOGIC DATA FOR A SUBSURFACE WASTE-INJECTION SITE AT MULBERRY, FLORIDA, 1972-77,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. E. Wilson, D. C. Parsons, and R. M. Spechler.
Geological Survey open-file report 79-683, 1979. 33 p, 4 Fig, 5 Tab, 3 Ref.

Descriptors: *Industrial wastes, *Waste disposal wells, *Injection wells, *Path of pollutants, *Chemical analyses, Liquid wastes, Water analysis, Observation wells, Aquifer characteristics, Dolomite, Limestones, Florida, Water levels, Hydrologic data, Hydrographs, *Mulberry(FL).

Since October 1972, industrial liquid waste has been injected into a brine aquifer of limestone and dolomite in Mulberry, FL., at a depth of more than 4,000 feet below land surface. During 1977, the injection rate was about 8.8 million gallons per month. To determine what effect the injected waste has on the ground-water body, water levels have been measured and water samples collected from two monitor wells that tap different permeable zones above the injection zone, and from a satellite monitor well that taps the injection zone. The monitor wells are in the annulus of the injection well, and the satellite monitor well is 2,291 feet from the injection well. This report updates previous data reports and includes all hydrologic data collected by the U.S. Geological Survey during 1972-77. Included is a table of well-construction data, a graph showing the volume of waste injected each month, and hydrographs of the annulus monitor wells and the satellite monitor well. (Woodard-USGS)
W80-01418

SEDIMENTS OF LAKE ROTORUA AS SOURCES AND SINKS FOR PLANT NUTRIENTS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
For primary bibliographic entry see Field 5C.
W80-01441

LAKES AND PHOSPHORUS INPUTS, A FOCUS ON MANAGEMENT,
New York State Coll. of Agriculture and Life Sciences, Ithaca.
For primary bibliographic entry see Field 5G.
W80-01465

VOLATILE ORGANIC COMPOUNDS IN SEAWATER,
Woods Hole Oceanographic Institution, MA. Dept. of Chemistry.
P. M. Gschwend.
Doctoral Dissertation, Woods Hole Oceanographic Institution Technical Report No. WHOI-79-72, August 1979. 272 p, 45 Fig, 13 Tab, 166 Ref, 5 Append.

Descriptors: *Organic compounds, *Sea water, *Water pollution sources, *Oil pollution, Spatial distribution, Temporal distribution, Volatility, *Biogenic sources, *Anthropogenic sources, Benzenes, Naphthalenes, Hydrocarbons, Pentadecane, Heptadecane, Sea Grant Program.

Vapor phase stripping and solid adsorbent trapping were applied to seawater and related samples to concentrate volatile organic compounds. The concentrates were subsequently analyzed by glass capillary gas chromatography and combined gas chromatography-mass spectrometry. The compound identities and the spatial and temporal distributions of their concentrations were used to determine some sources, transformations and transport mechanisms of organic matter in the sea. Volatile organic compounds were determined in seawater samples from the Sargasso Sea, the western Equatorial Atlantic, and the upwelling region off Peru. Pentadecane was present in all three areas in surface samples. The temporal variations of volatile organic compound concentrations were investigated in coastal seawater from Vineyard Sound, Massachusetts. Pentadecane and heptadecane showed large summertime concentrations increases which were ascribed to benthic algal sources. Laboratory incubations of benthic algal samples supported this conclusion. (NOAA)
W80-01539

POLLUTION CHARACTERISTICS IN AN UNPOLLUTED SUBARCTIC STREAM,
Alaska Univ., Fairbanks. Dept. of Environmental Health Sciences.
L. A. Peterson.
The Northern Engineer, Vol 10, No 1, p 15-17, Spring 1978. 2 Fig, 5 Ref, 4 Photo. OWRT-B-017-ALAS(7).

Descriptors: *Water pollution, *Water pollution sources, *Alaska, *On-site investigations, Subarctic, Streams, Groundwater, Cold regions, Dissolved oxygen, Hydrogen ion concentration, Sediments, Water properties, Water quality, Carbon dioxide, Iron, *Goldstream Creek(AK).

Goldstream Creek, a small subarctic stream, drains a region of increasing domestic development northwest of Fairbanks, Alaska. Observed variations in water quality occurred between the Ballaine Bridge (BB) and Sheep Creek Road Bridge (SCRB) sampling sites which drain 73.7 sq mi and 93.3 sq mi, respectively. A large bog area exists above the SCRB site north of the stream, and a smaller bog area lies above the BB site. Dissolved oxygen was essentially depleted (0.3 mg/l); ammonia-nitrogen, nitrate-nitrogen, and specific conductance values were abnormally high; and pH was below normal. These and other anomalies were observed during the winter of 1970-71. The source of pollution proved to be not human activity but a natural phenomenon. Groundwater seeping through organic silt deposits into the stream was responsible for the 'polluted' condition. The importance of this is that water quality standards are being implemented which, in a few cases, are higher than the natural quality. (Humphreys-ISWS)
W80-01545

TRANSBOUNDARY GROUND WATER POLLUTION: SURVEY AND TRENDS IN TREATY LAW,
Fordham Univ., Bronx, NY. School of Law.
For primary bibliographic entry see Field 6E.
W80-01546

MAGNITUDES, NATURE, AND EFFECTS OF POINT AND NONPOINT DISCHARGES IN THE CHATTAHOOCHEE RIVER BASIN, ATLANTA TO WEST POINT DAM, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.

J. K. Stamer, R. N. Cherry, R. E. Faye, and R. L. Klechner.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.00, Geological Survey Water-Supply Paper 2059, 1979. 65 p, 27 Fig, 22 Tab, 35 Ref.

Descriptors: *Water pollution sources, *Inflow, *Streams, *Water analysis, *Water pollution control, Streamflow, Flow rates, Data collections, Chemical analysis, Dissolved solids, Biochemical oxygen demand, Nitrification, Algae, Regulated flow, Urbanization, Powerplants, Thermal pollution, Waste water treatment, Georgia, *Chattahoochee River(GA), *West Point Lake(GA), Point-source discharge, Nonpoint-source discharge.

On an average annual basis and during the storm period of March 12-15, 1976, nonpoint-source loads for most constituents were larger than point-source loads at the Whitesburg station, located on the Chattachoochee River about 40 miles downstream from Atlanta, Ga. Most of the nonpoint-source constituent loads in the Atlanta to Whitesburg reach were from urban areas. Average annual point-source discharges accounted for about 50 percent of the dissolved nitrogen, total nitrogen, and total phosphorus loads and about 70 percent of the dissolved phosphorus loads at Whitesburg. During a low-flow period, June 1-2, 1977, five municipal point-sources contributed 63 percent of the ultimate biochemical oxygen demand, and 97 percent of ammonium nitrogen loads at the Franklin station, at the upstream end of West Point Lake. Dissolved-oxygen concentrations of 4.1 to 5.0 milligrams per liter occurred in a 22-mile reach of the river downstream from Atlanta due about equally to nitrogenous and carbonaceous oxygen demands. The heat load from two thermoelectric powerplants caused a decrease in dissolved-oxygen concentration of about 0.2 milligrams per liter. Phytoplankton concentrations in West Point Lake, about 70 miles downstream from Atlanta, could exceed three million cells per milliliter during extended low-flow periods in the summer with present point-source phosphorus loads. (Woodard-USGS)
W80-01590

SALTWATER ENCROACHMENT IN THE '600-FOOT' AND '1,500-FOOT' SANDS OF THE BATON ROUGE AREA, LOUISIANA, 1966-78, INCLUDING A DISCUSSION OF SALTWATER IN OTHER SANDS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
C. D. Whiteman, Jr.
Louisiana Department of Public Works Water Resources Technical Report No 19, 1977. 49 p, 11 Fig, 7 Plates, 3 Tab, 12 Ref.

Descriptors: *Saline water intrusion, *Groundwater, *Aquifer characteristics, *Saline water-freshwater interfaces, Aquifer management, Planning, Injection wells, Artificial recharge, Data collections, Water wells, Pumping, Water supply, Water quality, Projections, Groundwater movement, Water levels, Louisiana, *Baton Rouge area(LA).

Saltwater encroachment has been observed in the '600-foot', '2,000-foot,' and '2,800-foot' sands of the Baton Rouge area, La. The encroachment is the result of leakage of salty water across the Baton Rouge fault in response to pumpage north of the fault. Salty water in the '1,500-foot' sand may reach the Government Street well field in about 30 years, and a control strategy should be adopted and placed in operation as soon as possible to minimize contamination of the aquifer and damage to existing well fields. Encroachment in the '600-foot' sand may not produce serious problems for about 40 years, but the ultimate effects of encroachment in the '600-foot' sand may be more damaging than encroachment in the '1,500-foot' sand. If control measures are to be instituted for the '600-foot' sand, for maximum effectiveness, they should begin as soon as practical to do so and within about 20 years at the latest. Control measures in the other sands in which encroachment is indicated can probably be delayed longer if adequate monitoring is maintained. Of several possible control stragegies, the most practical will probably consist of discharge wells pumping salty water from the aquifers near the fault. Injection wells to dispose of the salty water will probably also be needed. (Woodard-USGS)
W80-01594

5C. Effects Of Pollution

PUBLIC INFORMATION AND LAKE EUTROPHICATION: A CASE STUDY OF GULL LAKE IN SOUTHWESTERN MICHIGAN,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
G. H. Lauff, B. Moss, and D. F. Tague.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113715, Price codes: A04 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report November, 1979. 72 p, 4 Fig, 15 Tab, 48 Ref. OWRT B-021-MICH (2), B-032-MICH (2), 14-21-0001-3599 and 14-31-0001-4.

Descriptors: *Lakes, *Phosphorus, *Fertilizers, *Spetic tanks, *Eutrophication, *Oxygen demand, *Gull Lake(MI), *Lawn fertilizers.

Since 1965 Gull Lake's water quality has rapidly deteriorated. The principal cause of its decline is phosphorus enrichment from septic systems and over-fertilized lawns. Efforts have been directed toward obtaining a reduction in phosphorus input through a community education and action program. A monitoring program has provided extensive baseline data. Dissemination of evidence documenting Gull Lake's degradation has helped motivate the citizenry to undertake corrective measures. Algal increases and changes, and the rate and extent of hypolimnetic oxygen depletion have been particularly useful toward this end. Total oxygen depletion in the lower-most water of Gull Lake was first recorded in 1966. The maximum development of oxygen depletion was recorded in the summer of 1972. The rate of oxygen depletion is directly related to the level of algal growth. To control phosphorus input from domestic sources, sewage must eventually be diverted from Gull Lake. In addition, the use of lawn fertilizers containing phosphorus must be eliminated on property adjacent to the lake. Evidence does point to the willingness of Gull Lake residents to accept life style changes resulting in reduction of nutrient input but these are likely inadequate to stabilize or reverse eutrophication trends. The lake community has worked closely with the townships and counties involved to initiate a sanitary sewer to service Gull Lake - grant decisions are pending.
W80-01255

EFFECTS OF AMMONIA ENRICHMENT AND HIGH LIGHT INTENSITY ON A SALT MARSH DIATOM COMMUNITY,
Mississippi State Univ., Mississippi State.
M. J. Sullivan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113483, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Mississippi State University Report, 1979. 53 p, 1 Fig, 12 Tab, 27 Ref. OWRT A-124-MISS (1), 14-34-0001-9026.

Descriptors: *Water pollution effects, *Diatoms, *Nitrogen, *Light intensity, *Salt marshes, Nutrients, Soil algae, Eutrophication, Bioindicators, Biological communities, Mississippi, Water quality, Ammonia, Light intensity, *Taxa, *Community structure, *Graveline Bay Marsh(MS), Distichlis, Nitzschia.

Edaphic diatoms were collected seasonally from a monotypic stand of Distichlis spicata on a Mississippi salt marsh, in which the marsh surface had been exposed to high light intensity by clipping the grass shoots and enriched with NH4Cl. Clipping greatly reduced species diversity (H') and the number of taxa in a sample (S) in all seasons except winter, but did not stimulate the growth of filamentous algae. Nitrogen enrichment increased H' and S in spring. Of the 111 taxa encountered, clipping eliminated 9 preexisting taxa and introduced 3 new taxa into the community. No such effect was induced by nitrogen enrichment. A 3-way ANOVA (light x nitrogen x date) of the relative abundances of the 16 most abundant taxa revealed that 11 taxa were characterized by a significant 3-way interaction term. As with community diversity, effects due to clipping were more prevalent than those due to nitrogen enrichment. However, two taxa -Nitzschia perversa and N. gandersheimiensis, may represent bioindicator organisms for detecting nitrogen enrichment in Gulf Coast salt marshes. Nitrogen enrichment greatly stimulated the aerial yield of control D. spicata stands and the regrowth of those clipped 3 months earlier. Thus, the D. spicata- edaphic diatom complex showed pronounced responses to the treatments employed and appears to have a capacity for assimilating exogenously added nitrogen.
W80-01258

ORIGIN AND VARIATION OF NITRATE NITROGEN IN THE CHALK SPRINGS, STREAMS, AND RIVERS IN DORSET AND ITS UTILIZATION BY HIGHER PLANTS,
Freshwater Biological Association, Wareham (England), River Lab.
Progress in Water Technology, Vol 8, No 4-5, p 225-235, 1977. 6 Fig, Tab, 28 Ref.

Descriptors: *Dorset(England), *Nitrates, *Macrophytes, *Water pollution sources, *Nutrient budgets, *Nitrogen, Rivers, Streams, Springs, Boreholes, Frome River(England), Piddle River(England), Hydrogeology, Ranunculus penicillatus var. calcareus, Rorippa nasturtium aquaticum, Watercress, Rainfall, Sewage disposal, Effluents, Chalk, England.

Nitrate concentrations in chalk streams and boreholes in Dorset were fairly constant 1968-73, whereas in similar sites elsewhere in England there were large increases, possibly due to differences in farming practices or geology. In the major river of the Dorset study area, the River Frome, mean nitrate concentration increased 1965-72, which cannot be accounted by sewage effluent increases of 29% over the period, and rainfall at most could have contributed 28.9% of total nitrate throughout; the increase must therefore be due to increased fertilizer use, growth of more legume crops, or more nitrogen imported as livestock food. Utilization of the nitrate-nitrogen by the higher plants Ranunculus penicillatus var. calcareus and Rorippa nasturtium (watercress) was low, about 2% of the throughput. Samples of rainfall and water from the boreholes, springs, streams, and main river were analyzed to determine nitrate-nitrogen sources in the system, and the range and variation of nitrate values at times of increased flow. The River Frome and River Piddle systems lie in a shallow chalk basin overlying lower Cretaceous strata. In much of the basin areas the chalk is overlaid by Eocene acid sands and clays. Nitrate-nitrogen content of rainwater varied 0.02-2.09 mg/l, with mean 0.31 mg/l. Rainfall could account for 3.3 kg/ha/yr NO3-N. Total sewage effluent into the River Frome increased from 0.54 cu m/sec in 1965 to 0.70 cu m/sec in 1972. (Lynch-Wisconsin)
W80-01276

STATISTICAL ASSESSMENT OF INORGANIC NITROGEN IN A SMALL RIVER SYSTEM,
Cornell Univ., Ithaca, NY.
K. S. Porter.
Progress in Water Technology, Vol 8, No 4-5, p 253-274, 1977. 7 Fig, 7 Tab, 7 Ref.

Descriptors: *Statistical models, *Nitrogen, *Lee River(England), *Nitrates, *Water pollution sources, *Inorganic nitrogen, Nutrients, Nutrient loading, Rivers, Methodology, Regression analysis, River basins, Thames River(England), Tributaries, Model studies, Time series analysis, Sewage disposal.

Detailed statistical analysis using linear models obtained by least squares methods was used with 1966-71 data from the River Lee system, England, to quantify inorganic nitrogen levels in the river and relate them to major point and nonpoint pollution sources within the watershed via linear regres-

sion. Also described are effects of such factors as time and population on nitrogen load. The River Lee, a tributary of the River Thames, has nitrate concentrations higher than in the Thames, approaching the WHO recommended limit of 11.3 mg N/l for drinking water. Analysis shows that least-squares estimation can be used quantitatively to account for concentrations and loads of inorganic nitrogen in a river system, and that factors underlying a system's features can be identified. The four main observation points were Rye House, River Stort, Dobbs Weir, and Lea Valley Road, plus the two large sewage works at Luton and Rye Meads. The more detailed analysis of data from Rye Meads demonstrated that increasing inorganic nitrogen at Lea Valley Road of about 0.54 mg/l/yr was partly attributable to the increase in population served by the works. Models indicate there could be a further rapid deterioration in the quality of the River Lea; the deterioration is the result of a larger annual increase upstream at Dobbs Weir of about 0.75 mg/l/yr inorganic nitrogen, and not of an unmeasured nitrate source between Dobbs Weir and Lea Valley Road. (Lynch-Wisconsin).
W80-01284

NITROGEN - A GROWTH LIMITING NUTRIENT IN EUTROPHIC LAKES,
National Swedish Environmental Protection Board, Uppsala. Algal Assay Lab.
A. Claesson, and S. O. Ryding.
Progress in Water Technology, Vol 8, No 4-5, p 291-299, 1977. 5 Fig, 1 Tab, 17 Ref.

Descriptors: *Eutrophication, *Water chemistry, *Bioassay, *Cycling nutrients, Limiting factor, Sewage effluents, Algae, Nitrogen, Phosphorus, Nutrients, Water quality, Chlorophyll, Selenastrum capricornutum, Sweden, Seasonal.

Water chemistry and algal assay test data from five of 18 eutrophic Swedish lakes studied May-October 1973 illustrate relationships between nitrogen and phosphorus as primary growth limiting nutrients. In less productive lakes nitrogen influences algal growth, to an extent greater than in the more eutrophic water bodies, where light or zooplankton predation limits phytoplankton growth. Analysis of the surface waters (0-2 m) displayed low concentrations of nitrogen, excess concentrations of phosphorus, and a high chlorophyll a content throughout summer periods. The most productive lakes, however, continued to exhibit a high nitrogen supply. When the total nitrogen: total phosphorus quotient was about 15:1 in lake water, phosphorus was a growth limiting nutrient, but below 15:1 nitrogen alone was the most limiting factor. Selenastrum capricornutum biomass was expressed as chlorophyll a. The sum of lake and algal assay chlorophyll was used to indicate algal growth potential in lakes and is proposed as a trophic index. (Danovich-Wisconsin)
W80-01308

NOTES ON MUDDY ODOUR. I SENSORY PROPERTIES AND ANALYSIS OF 2-METHYLISOBORNEOL IN WATER AND FISH,
Helsinki Univ., (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5A.
W80-01316

NOTES ON MUDDY ODOUR. II UPTAKE OF 2-METHLISOBORNEOL BY RAINBOW TROUT (SALMO GAIRDNERI) IN CONTINUOUS FLOW AQUARIA,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5A.
W80-01317

INTERTIDAL DISPOSAL OF DREDGED MATERIAL IN WASHINGTON ESTUARIES,
Washington State Dept. of Game, Olympia.
R. Albright.
In: The Use, Study and Management of Puget Sound, A Symposium, March 23-25, 1977, University of Washington, Seattle, p. 158-172, 1977. 8 Fig, 15 Ref.

Descriptors: *Sediments, *Dredging, Dredged material, *Benthos, Amphioda, Corophium, *Shore birds, Water birds, Intertidal areas, Washington, Elevation, Animal populations, *Grays Harbor (Wash).

A study was conducted to evaluate the effects of dredging of Grays Harbor, Washington, on the organisms utilizing the area. This project was co ncerned with the effects of the disposal of dredged material on shore birds. The impact on the benthic community was severe. The number of species was 66% lower in the disposal area. The mean numbers of individuals and biomass was 96.7% lower than at the control stations. These changes were caused by changes in the land elevation and sediment composition. The impact on the benthic populations is expected to be permanent. The shore bird usage of the area was markedly changed. (Katz-EIS).
W80-01319

AN ASSESSMENT OF THE EFFECTS OF SUBTIDAL SEWAGE OUTFALLS ON INTERTIDAL MACROFAUNA OF SEVERAL CENTRAL PUGET SOUND BEACHES,
Washington Univ., Seattle.
For primary bibliographic entry see Field 5A.
W80-01320

IMPACT OF SEWAGE ON BENTHIC MARINE FLORA OF THE SEATTLE AREA: PRELIMINARY RESULTS,
Washington Univ., Seattle.
For primary bibliographic entry see Field 5A.
W80-01321

EFFECTS OF PROLONGED EXPOSURE TO AMMONIA ON THE BLOOD AND LIVER GLYCOGEN OF COHO SALMON (ONCORHYNCUSH KISUTCH),
Municipality of Metropolitan Seattle, WA. Water Quality Lab.
For primary bibliographic entry see Field 5A.
W80-01322

ANALYSIS OF COMBINED EFFECT OF POLLUTANTS ON BIOLOGICAL SYSTEMS,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 5A.
W80-01323

THE INFLUENCE OF HEAVY METALS ON A MIXED BACTERIAL POPULATION OF SEWAGE ORIGIN IN THE CHEMOSTAT,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
J. N. Lester, R. Perry, and A. H. Dadd.
Water Research, Vol 13, p 1055-1063, 1979. 9 Fig, 33 Ref.

Descriptors: *Heavy metals, *Toxicity, *Sewage bacteria, Cytological studies, *Copper, *Cadmium, *Chromium, *Lead, Bacteria, Pseudomonas, Growth rates, *Chemostat.

A reproducible mixed continuous bacterial population has been cultured in the chemostat at a low dilution rate. Four species originally isolated from activated sludge were used to provide an inoculum. The influence of cadmium, chromium, copper and lead as shock doses has been examined at concentrations of 50 mg/l and the response of the population was found to vary for each metal. The most toxic metal was copper followed by cadmium, lead and chromium. Continuous doses of chromium and lead have been studied, the latter over a range of concentrations. It appears that concentrations of lead as low as 5 mg/l cause modifications in the individual population sizes. Some of the species studied were found to be more resistant to heavy metal toxicity than others. (Deal-EIS).
W80-01324

EFFECTS OF SUBLETHAL CONCENTRATIONS OF CADMIUM AS POSSIBLE INDICATORS OF CADMIUM POLLUTION FOR TWO POPULATIONS OF ACARTIA CLAUSI (COPEPODA) LIVING AT TWO DIFFERENTLY POLLUTED AREAS,
Athens Univ. (Greece). Zoological Lab. and Museum.
M. Moraitou-Apostolopoulou, G. Verriopoulos, and P. Lentzou.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 642-649, 1979. 3 Fig, 2 Tab, 16 Ref.

Descriptors: *Cadmium, *Toxicity, *Adaptation, *Copepods, Animal physiology, Animal metabolism, Heavy metals, Mortality, Respiration, Oxygen requirements, Aging(Biological), Bioindicators, *Acartia.

The purpose of this study was twofold: first to establish and characterize the sublethal effects of cadmium on different physiological processes (longevity, feeding, respiratory rates), and second to verify whether there exist differences in the effects of sublethal concentrations of cadmium between the two populations of Acartia adapted to differently polluted areas. All tested concentrations reduced longevity with respect to controls. Generally, the mean longevity declined with increasing Cd concentration. As Cd concentration increased feeding rate decreased up to a certain value, then feeding rate abruptly increased. Respiration rates and oxygen consumption increased with increasing Cd concentration. In general, the pollution-adapted population was more resistant to the effects of Cd as compared to the population from a non-polluted environment. (Deal-EIS)
W80-01329

DETOXIFICATION SYSTEM IN POLYCHAETE WORMS: IMPORTANCE IN THE DEGRADATION OF SEDIMENT HYDROCARBONS,
Skidway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5B.
W80-01330

CONDITION INDEX AND FREE AMINO ACID CONTENT OF MACOMA INQUINATA EXPOSED TO OIL-CONTAMINATED MARINE SEDIMENTS,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
For primary bibliographic entry see Field 5B.
W80-01331

PHYSIOLOGICAL BASIS OF DIFFERENTIAL SENSITIVITY OF FISH EMBRYONIC STAGES TO OIL POLLUTION,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-01332

TOXIC CATIONS AND MARINE BIOTA: ANALYSIS OF RESEARCH EFFORT DURING THE THREE-YEAR PERIOD 1974-1976,
Environmental Research Lab., Narragansett, RI
For primary bibliographic entry see Field 5A.
W80-01333

EFFECTS OF MERCURY, CADMIUM, AND LEAD COMPOUNDS ON REGENERATION IN ESTUARINE FISHES AND CRABS,
Rutgers - The State Univ., Newark, NJ. Dept. of Zoology and Physiology.
J. S. Weis, and P. Weis.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 151-169, 1979. 5 Fig, 3 Tab, 53 Ref.

Descriptors: *Toxicity, *Heavy metals, *Crabs, *Killifishes, *Cadmium, *Mercury, Lead, Animal physiology, Animal metabolism, Mode of action, Bioindicators, Chlorides, Growth rates, Methyl mercury, *Regeneration.

Fin regeneration in the killifish, Fundulus heteroclitus, was retarded by exposure to CdCl2 at 0.01 and 0.1 mg/l. HgCl2 had no effect at levels which were sublethal. However, regeneration in F. confluentus was retarded by exposure to methylmer-

curic chloride at 0.01 and 0.05 mg/l, but the effect was reduced to insignificance when the salinity of the water was reduced or when CdCl2 was also present in the water. Regeneration of limbs in the fiddler crab, Uca pugilator, was studied after exposure to heavy metals following multiple autotomy. CdCl2 at 0.1 and 1.0 mg/l retarded the regeneration rate but HgCl2 inhibited regeneration only at 1.0 mg/l; this concentration proved lethal to many crabs. Methylmercury, however, severly inhibited regeneration at 0.5 mg/l and caused inhibition of melanogenesis in regenerates at 0.1 mg/l. Combinations of methylmercury and CdCl2 were additive in sea water. (Deal-EIS)
W80-01334

HEMATOLOGICAL EFFECTS OF LONG-TERM MERCURY EXPOSURE AND SUBSEQUENT PERIODS OF RECOVERY ON THE WINTER FLOUNDER, PSEUDOPLEURONECTES AMERICANUS,
National Marine Fisheries Service, Milford, CT. Northeast Fisheries Center.
For primary bibliographic entry see Field 5B.
W80-01335

THE USE OF BIVALVE MOLLUSCS IN HEAVY METAL POLLUTION RESEARCH,
North Carolina Central Univ., Durham. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-01336

PRELIMINARY OBSERVATIONS ON THE CYTOPATHOLOGICAL EFFECTS OF COPPER SULFATE ON THE CHEMORECEPTORS OF CALLINECTES SAPIDUS,
National Marine Fisheries Service, Oxford, MD. Northeast Fisheries Center.
For primary bibliographic entry see Field 5B.
W80-01337

COPPER AND CADMIUM INDUCED CHANGES IN THE METABOLISM AND STRUCTURE OF MOLLUSCAN GILL TISSUE,
National Marine Fisheries Service, Beaufort, NC. Southeast Fisheries Center.
For primary bibliographic entry see Field 5B.
W80-01338

FATTY ACID COMPOSITION OF PHOSPHOLIPIDS IN THERMALLY ACCLIMATING SCULPINS (LEPTOCOTTUS ARMATUS) TREATED WITH POLYCHOLRINATED BIPHENYLS (AROCLOR 1254),
Oregon State Univ., Newport. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5B.
W80-01339

PHYSIOLOGICAL AND BIOCHEMICAL INVESTIGATIONS OF THE TOXICITY OF PENTACHLOROPHENOL TO CRUSTACEANS,
University of West Florida, Pensacola. Faculty of Biology.
For primary bibliographic entry see Field 5B.
W80-01340

A BENTHIC BIOASSAY USING TIME-LAPSE PHOTOGRAPHY TO MEASURE THE EFFECT OF TOXICANTS ON THE FEEDING BEHAVIOR OF LUGWORMS (POLYCHAETA: ARENICOLIDAE),
University of West Florida, Pensacola. Faculty of Biology.
For primary bibliographic entry see Field 5A.
W80-01341

SEASONAL MODULATION OF THERMAL ACCLIMATION AND BEHAVIORAL THERMOREGULATION IN AQUATIC ANIMALS,
Massachusetts Univ., Amberst. Dept. of Zoology.
J. L. Roberts.
In: Marne Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 365-388, 1979. 8 Fig, 62 Ref.

Descriptors: *Seasonal, *Bioindicators, *Water temperature, Animal metabolism, Oxygen requirements, Animal behavior, Respiration, Adaptation, Photoperiodism, Animal physiology, Sunfishes, Brown trout, Bullheads, Sockeye salmon, Habitats, Mode of action.

Special emphasis has been placed here on the potential of behavioral responses for indication of contaminant effects on aquatic organisms. This potential has been illustrated by the utility of shuttlebox aquariums for determination of thermal preferenda. Thermal preferenda have been identified as ranges in temperature at which aquatic organisms do not receive thermal feedback from the environment that is inductive of aversive or avoidance responses. The thermal preferendum of a species is liable to modification by seasonal changes in temperature and probably as well by photoperiod change. The fact that locomotory activity of aquatic ectotherms can increase in some proportion with the magnitude of temperature change above and below a seasonal thermal preferendum (averse responses) suggests that behavioral thermoregulation in subject to a sort of central proportioning control. That is, a variable set-point thermostat does not seem to provide an appropriate analogue for the control system. (Deal-EIS)
W80-01342

EFFECT OF DIMILIN ON DEVELOPMENT OF LAKE LARVAE OF THE STONE CRAB MENIPPE MERCENARIA, AND THE BLUE CRAB, CALLINECTES SAPIDUS,
Duke Univ., Beaufort, NC. Marine Lab.
J. D. Costlow.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press New York, p 355-363, 1979. 2 Fig, 18 Ref.

Descriptors: *Pesticide toxicity, *Larval growth stage, *Crabs, Insecticides, Bioassay, Salinity, Water temperature, Mortality, Path of pollutants, *Dimilin.

Larvae of the two crabs species were exposed to four concentrations of Dimilin (0.5, 1.0, 3.0, 6.0 ppb) at six combinations of temperature and salinity. All experimental concentrations were lethal to the larvae of the stone crab. Blue crab survival showed considerable variation, both in relation to the concentration of Dimilin and relative to the salinity/temperature combination. From the results of this work, as well as the limited observations on other non-target organisms, it is apparent that Dimilin, while a highly effective insecticide, must be used with extreme caution in areas which serve as a watershed to estuarine and coastal waters. (Deal-EIS)
W80-01343

SEASONAL EFFECTS OF CHLORINE PRODUCED OXIDANTS ON THE GROWTH, SURVIVAL AND PHYSIOLOGY OF THE AMERICAN OYSTER, CRASSOSTREA VIRGINICA (GMENLIN),
National Marine Water Quality Lab., John's Island, SC.
G. I. Scott, and W. B. Vernberg.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 415-435, 1979. 7 Fig, 3 Tab, 29 Ref.

Descriptors: *Oysters, *Toxicity, *Chlorine, Mortality, Seasonal, Water temperature, Animal physiology, Animal metabolism, Respiration, Animal behavior, Bioassay, Growth rates, Mode of action, *Tissue analysis.

Chronic exposure of Crassostrea virginica to chlorine produced oxidant (CPG) products is highly toxic at high concentrations; severe sublethal effects occur at low concentration levels. The degree of toxicity, however, varies from season to season and is related to seasonal changes in measured CPO concentrations, water temperatue, and the physiological condition of the oyster. The combination of various CPO concentrations and high water temperatures significantly decreased survival and increased respiration rates in exposed oysters, probably due to a sublethal synergistic physiological stress and a lethal synergistic effect on survival due to the interaction of these factors. Other sublethal effects appear to be related to reductions in feeding and increased avoidance of CPO which results in reduced levels of tissue production. (Deal-EIS)
W80-01344

BEYOND THE LC50: AN OPINION ABOUT RESEARCH ACTIVITIES AND NEEDS CONCERNING PHYSIOLOGICAL EFFECTS OF POLLUTANTS IN THE ENVIRONMENT,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
For primary bibliographic entry see Field 5B.
W80-01345

CADMIUM TOXICITY TO FRESHWATER ALGAE,
Canada Centre for Inland Waters Burlington (Ontario).
P. T. S. Wong, G. Burnison, and Y. K. Chau.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 487-490, 1979. 2 Fig, 10 Ref.

Descriptors: *Cadmium, *Toxicity, *Bioindicators, Monitoring, Aquatic algae, Chlorella, Scenedesmus, Growth rates, Absorption, Cytological studies, Radiochemical analysis, Tracers.

The effect of cadmium, as Cd nitrate, Cd chloride, Cd carbonate and Cd acetate, on cell growth was examined in four algal species (Ankistrodesmus falcatus, Chlorella vulgaris, Scenedesmus quadricauda and Chlorella pyrenoidosa). The effect of Cd chloride on 14C-carbonate uptake by all four algal species was also tested. No cell growth was found above a concentration of 5 ppm Cd. The toxicity of Cd was more marked in bay water than a culture medium for any of the four Cd salts tested. In the uptake experiment it was reported that the different algal species responded differently to Cd. For S. quadricauda the presence of Cd as low as 20 ppb inhibited 80% of its 14C-uptake. The other three species were less sensitive to Cd. (Deal-EIS)
W80-01347

THE EFFECT OF EXPOSURE TEMPERATURES ON OXYGEN CONSUMPTION AND OPERCULAR BREATHING RATES OF PINK SALMON FRY EXPOSED TO TOLUENE, NAPHTHALENE, AND WATER-SOLUBLE FRACTIONS OF COOK INLET CRUDE OIL AND NO. 2 FUEL OIL,
California State Univ.-Chico. Dept. of Biological Science.
R. E. Thomas, and S. D. Rice.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p. 39-52, 1979. 4 fig. 18 ref.

Descriptors: *Fish physiology, *Toxicity, *Oil, Organic compounds, Fuels, Pink salmon, Fry, Oxygen requirements, Respiration, Fish behavior, Animal metabolism, Mode of action, *Toluene, *Napththalene, *Crude oil.

All three concentrations of naphthalene (107%, 70%, and 45% of the 24-h TLm) resulted in significant increases in the opercular breathing rate of pink salmon fry, while of the four toluene concentrations (94%, 69%, 45%, and 30% of the 24-h TLm), only the two highest resulted in a significant increase in the breathing rate. The two higher napthalene concentrations resulted in significant increases in breathing rate for the entire 25-h exposure but only the highest toluene concentration caused a significantly elevated respiratory rate for the entire 15-h period, even though the exposure concentration in all of these tests were stable. Some fry died during the exposure to the highest concentrations of napthalene and toluene. Oxygen consumption and breathing rates of fry exposed to

toluene and napthalene began to increase immediately upon exposure and declined later hours during exposure. Breathing rate reached maximum response values at 2 or 4 h, while the oxygen consumption rates were greatest at 6 or 8 h of exposure. The breathing rate responses to exposures of Cook Inlet crude oil WSF and No. 2 fuel oil WSF at 4 and 12C are similar to the responses of fry exposed to toluene and napthalene. The effect of temperature on breathing rate response to No. 2 fuel oil was approximately the same as observed in tests with napthalene. (Deal-EIS)
W80-01348

SEDIMENT AND WATER QUALITY: A REVIEW OF THE LITERATURE INCLUDING A SUGGESTED APPROACH FOR WATER QUALITY CRITERIA WITH SUMMARY OF WORKSHOP AND CONCLUSIONS AND RECOMMENDATIONS,
Washington Univ., Seattle. Fisheries Research Inst.
R. N. Iwamoto, E. O. Salo, M. A. Madej, and R. L. McComas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 469, Price codes: A12 in paper copy, A01 in microfiche. Report EPA 910/9-78-048, February 1978. 252 p, 4 Append.

Descriptors: *Sedimentation, *Water quaity, *Turbidity, *Lotic environment, *Conferences, *Bibliographies, Sediment transport, Sediment load, Sediments, water circulation, Publications, Bed load, Productivity, Streams, Aquatic life, Land use, Movement, Flow, Seattle(WA), Federal Water Pollution Control Act.

While turbidity measurements indicate suspended sediment quantities, turbidity is difficult to relate to significant biological changes. Alternative approaches to turbidity measurements as a water quality criterion include: bed material composition, aquatic fauna behavioral aspects, and stress measured clinically by physiological functions. Bed material composition, principally the percentage of fines less than 0.850 mm diameter, affects primary and secondary productivity. A 10% to 20% limit for sediments less than 0.850mm is suggested as a criterion. Gravel for spawning produces significant detrimental effects on salmonid resources. A literature review summary, with 300 annotated and 100 unannotated referenvces, dealing with physical and biological aspects of sedimentation in the logic environment is included. Some states have adopted forest 'best management practices' which allow for flexible standards. Consensus of workshop held in Seattle Washington, 10 March 1977, included updating and monitoring best management practices and continued investigation of alternative approaches for water quality criteria. (Danovich-Wisconsin)
W80-01349

NITRATE UTILIZATION BY THEMATOM SKELETONEMA COSTATUM, I. KINETICS OF NITRATE UPTAKE,
Bilbao Univ., (Spain). Dept. of Biochemistry.
J. L. Serra, M. J. Llama, and E. Cadenas.
Plant Physiology, Vol 62, No 6, P 987-990, December 1978, 6 Fig, 25 Ref.

Descriptors: *Nitrates, *Diatoms, *Kinetics, Metabolism, Phytoplankton, Growth rates, Biochemistry, Microbiology, Marine algae, Nitrates, Ammonium salts, Bioassay, Michaelis-Meuten equations, Chemical analysis, Cycling nutrients, Nutrients, Nutrient requirements.

Nitrogen-deficient cells of Skeletonema costatum do not follow classical saturation kinetics when nitrate concentrations become higher than six micro M, but a high Vi nitrate value is obtained due to the additive, simultaneous contribution of a linear simple diffusion and a hyperbolic saturation transfer, with a carrier of nitrate. Cycloheximide and p-hydroxymercuribenzoate inhibit the carrier-mediated component to nitrate uptake without affecting the diffusion component. This paper characterizes nitrate uptake kinetics in Skeletonema costatum, phytoplankton organism ecologically significant because of its wide distribution. When N-deficient cells are preincubated four h with one micro M NaNo3, nitrate uptake increases and nitrate release decreases with a net increase in N assimilation. This can be explained by assuming that the permease, and/or nitrate and nitrite reductases, is nitrate-inducible. In preincubated cells, these protein cellular levels are higher than in non-preincubated cells, leading to increaed N assimilation. Nitrate is excreted following classical saturation kinetics, its rate being independent of nitrate concentration for values higher than three micro M. Uptake rates of nitate or ammonium by marine phytoplankton yield hyperbolae when plotted against the external nitrate or ammonium concentration. (Danovich-Wisconsin) (See also W80-01351)
W80-01350

NITRATE UTILIZATION BY THE DIATOM SKELETONEMA COSTATUM, II. REGULATION OF NITRATE UPTAKE,
Bilbao Univ. (Spain). Dept. of Biochemistry.
J. L. Serra, M. J. Llama, and E. Cadenas.
Plant Physiology, Vol 62, No 6, P 991-997, December 1978. 4 Fig, 25 Ref.

Descriptors: *Kinetics, *Nitrate, *Diatoms, *Plant physiology, Nutrients, Cycling nutrients, Nitrate, Ammonium salts, Nitrogen, Nitrogen cycle, Cycling nutrients, Biochemistry, Microbiology, Growth rates, Productivity, Chemical analysis, Phytoplankton, Amino acids, Metabolism, Cytological studies.

This paper deals with the effect of ammonium, nitrate, and amino acids on the isolated nitrate uptake system, once nitrate reductase activity has been inhiabited by tungstate, on N-deficient cells of the marine diatom Skeletonema costatum. Tungstate partially alters carrier-mediated nitrate uptake, but diffusion uptake remains unchanged. Cells were preincubated with CHI or with NEM and in both cases the contribution of carrier-mediated hyperbolic transport was negligible, while linear diffusion processes remained unaltered. Ammonium readily affects nitrate uptake in the same way as CHI and NEM; these results explain the partial inhibition by ammonium of permease for nitrate uptake. However, nitrate did not affect nitrate uptake kinetics type. Nitrate uptake was assayed separately in darkeness and in the presence of amino acids and no inhibition was found. A model is proposed for regulation of nitrate assimilation by S. costatum. The permease responsible for nitrate transfer might be the same carrier responsible for nitrate release but with different affinities for both ions in the inner and outer membrane faces. The permeases and the nitrate reductase might together make up a nitrate transfer-reduction system. CHI, NEM, p-HMB and tungstate affect, although in different ways, the three functions (two transfers plus reduction) simultaneously and may be performed by a single system. The increase in nitrate uptake and decrease in nitrate release can be explained by assuming the system and nitrate reductase are both nitrate-inducible and CHI sensitive. (See also W80-01350) (Danovich-Wisconsin)
W80-01351

CHEMICAL COMPOSITION OF AQUATIC MACROPHYTES, I. INVESTIGATION OF ORGANIC CONSTITUENTS AND NUTRITIONAL POTENTIAL,
Guelph Univ. (Ontario). Coll. of Biological Science.
A. J. Muztar, S. J. Slinger, and J. H. Burton.
Canadian Journal of Plant Science, Vol 58, No 3, p 829-841, July 1978. 5 Tab, 23 Ref.

Descriptors: *Aquatic plants, *Lake Ontario, *Chemung Lake, Canada, *Chemical analysis, *Feeds, *Fibers, *Beneficial use, *Aquatic weed control, Canada, Silage, Energy, Biochemistry, Speciation, Proteins, Plant Physiology, Plant tissues, Growth stages, Nutrients, Cellulose.

Chemical studies of four aquatic plant species from Chemung Lake, Ontario and from Lake Ontario during summer 1974 show that aquatic plant utilization from hard water lakes is a limited nutrient source for domestic animals because of high water and ash contents. High ash content is mostly due to surface contamination and can be reduced by washing, thus increasing nutritive value but also involving additional costs. Various chemical constituents such as gross energy and proximate components (crude fiber, crude protein, ash) and variation of these components with harvesting time were determined for Myriophyllum spicatum, Vallisneria americana, Potamogeton sp and Cladophora glomerata. Ash content ranges from 16% for Potomogeton harvested in July to 63.7% for M. spicatum in the same month. No general trend for ash variation with harvesting time is obvious; ash content increases only in Potamogeton at later harvest times. Crude protein levels vary from 7.7% for M. spicatum harvested in August to 18.3% for V. americana cut in September. Crude fiber levels fluctuate in all species over the three harvesting times with a 9.8% low and 24.04% high. Gross energy values fluctuate from 1.77 kcal/g for M. spicatum in July to 4.03 kcal/g for Potamogeton in August. Neutral-detergent fiber level is lowest for M. spicatum collected in August (14.2%) and highest for Potamogeton (52%) harvested in August-September. Acid-detergent fiber content ranges from 13.7% for M. spicatum in August to 41.4% for C. glomerata in September. Cellulose levels fluctuate from 11 to 26%. (Danovic-Wisconsin)
W80-01352

CHEMICAL COMPOSITION OF AQUATIC MACROPHYTES. III. MINERAL COMPOSITION OF FRESHWATER MACROPHYTES AND THEIR POTENTIAL FOR MINERAL NUTRIENT REMOVAL FROM LAKE WATER,
Guelph Univ. (Ontario). Dept. of Nutrition.
A. J. Muztar, S. J. Slinger, and J. H. Burton.
Canadian Journal of Plant Science, Vol 58, No 3, p851-862, July 1978. 6 Tab, 34 Ref.

Descriptors: *Aquatic plants, *Chemical analysis, *Metals, *Hardness(Water), *Nutrient removal, Canada, Lake Ontario, Chemung Lake, Canada, Specification, Plant physiology, Growth stages, Aquatic weed control, Alfalfa, Feeds, Silage, Nutrients, Calcium carbonate, Calcium compounds, Calcium, Copper.

Physiological needs, growth stage, and water fertility were critical factors in aquatic macrophyte nutrient composition in a summer 1974 and 1975 study of five species from Chemung Lake and Lake Ontario, Canada. The study investigates variations and differences in mineral content and mineral-stripping potential of aquatic macrophytes with species and harvesting time. Species observed include Cladophora glomerata, Myriophyllum spicatum, Lemna minor, Potamogeton, and Vallisneria americana. Calcium (CA) contents range from 5% for V. americana harvested in September to 23.7% for M. spicatum cut in July. High CA levels result from CaC03 deposition on plant surface tissues; unwashed plants contain 2-6 times more Ca than washed plants. In all plants species samples, washed or unwashed, Ca levels vary almost directly with ash contet. Sodium (Na) levels increase considerably with harvesting time from July onwards in all species; however, M. spicatum and V. americana harvested in September represent a second cutting. Levels of Cu, Zn, and Mn are variable with Cu (1-31 ppm) and Mn (34-1998 ppm) ranges particularly large. Compared with alfalfa, aquatic macrophytes contain much higher Fe, Ca, Na, and Mn levels but slightly lower P, K, and Se levels: Mg, Cu, and Zn levels are present in similar quantities. Analyses indicate that significant mineral quantities are removed from lakes by mechanical plant harvesting. Mature plants have low nutritive value as animal feedstuffs because of high ash content but can be used for mulch or compost material. (Danovich-Wisconsin)
W80-01353

THE RELATIONSHIP BETWEEN INORGANIC AND ORGANIC NUTRIENTS IN SEA WATER,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
E. I. Butler, S. Knox, and M. I. Liddicoat
Journal of the Marine Biological Association of the

United Kingdom, Vol 59, No 1, p 239-250, 1979. 3 fig, 6 Tab, 34 Ref.

Descriptors: *Nitrogen, *Phosphorus, *English Channel, *Cycling nutrients, Nutrients, Water chemistry, Phytoplankton, Productivity, Speciation, Nitrates, Phosphates, Nutrient budgets, Nitrogen compounds, Inorganic compounds, Organic compounds, Phosphorus compounds, Nutrient requirements, Sea water.

An 11-year study indicates that waters in the western English Channel always contain some form of dissolved nitrogen (N) and phosphorus (P). As one dissolved N form, nitrate (NO3), is utilized, another dissolved N fraction, dissolved organic nitrogen (DON), usually increases. While NO3 values decrease from 7.0 micro g/l monthly average in winter to 0.5 micro g/l in summer, DON usually increases from a 4.5 micro g/l winter monthly average to 10.0 micro g/l in summer. However, P curves do not show trends as clearly as those of N. Average monthly values range in January, July and October from 0.52 to 0.21 to 0.38 micro g/l for phosphate, respectively, and 0.15 to 0.21 to 0.14 micro g/l for dissolved organic phosphorus, respectively. Some phytoplankton species directly utilize at least part of DON, such as urea. As NO3 is exhausted, phytoplankton populations may shift to species capable of utilizing other N forms, throwing doubt on classical nutrient limiting growth theories. Results also show a relatively constant twenty to one TN:TP ratio throughout the year, TN varies from 11.6 to 9.9 to 10.4 micro g/l and TP varies from 0.67 to 0.42 to 0.55 micro g/l for monthly averages in January, July, and November, respectively. (Danovich-Wisconsin)
W80-01354

A REAL TIME MODEL OF NITROGEN-CYCLE DYNAMICS IN AN ESTUARINE SYSTEM,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynaics.
T. O. Najarian, and D. R. F. Harleman.
Progress in Water Technology, Vol 8, No 4-5, p 323-345, 1977. 26 Fig, 7 Tab, 12 Ref.

Descriptors: *Computer models, *Nitrogen cycle, *Estuaries, *Effluents, Hydrodynamics, Water quality, Computer simulation, Waste water discharge, Phytoplankton, Aquatic system, Tidal flow, Zooplankton, Estuarine environment, Model studies, Cycling nutrient.

A computer analysis of the response of an estuary to the input of waste water treatment effluent reveals the importance of coupling tidal transparent dynamics with biochemical and ecological processes. A real-time model obtains better results than a tidal average model because it realisticaly simulates ocean boundary conditions. The real time model explains effluent transport upstream of the point of injection due to flow reversal in the estuary caused by tides. An analysis of simple batch systems reveals the structured closed loop nitrogen-cycle has limit cycle characteristics; system response depends on whether or not it is open to matter flow; system variations occur with changes in parameters which govern the rate of transformation processes. Three objectives were established in formulating the study: (1)presenting a developed model for aerobic nitrogen limited aquatic systems; (2) predicting the estuaring response to future increases in waste water treatment facilities, and (3) coupling transport dynamics with nitrogen cycle dynamics. Ths basic principle of mass conservation of nitrogen was applied to various storage forms of the nutrient throughout its cycle. This closed loop nitrogen cycle model is important for estuarine phytoplankton dynamics. Seven storage variables and twelve biological and ecological transformations of nitrogen from one storage form to another were used in through-flow and unsteady-flow runs. Transformation rates were functions of nutrient concentrations and available energy levels. (Danovich-Wisconsin)
W80-01355

THE FAUNA OF THE MUDDY SEDIMENTS OF LOUGH NEAGH, WITH PARTICULAR REFERENCE TO EUTROPHICATION,
New Univ. of Ulster, Coleraine (Northern Ireland). Limnology Lab.
C. E. Carter.
Freshwater Biology, Vol 8, No 6, p 547-559, December 1978. 11 Fig, 2 Tab, 20 Ref.

Descriptors: *Estrophication, *Sediments, *Diptera, *Benthic fauna, *Oligochaetes, Bottom sediments, Lake sediments, Tubificids, Oxygen, Productivity, Bioindicators, Dominant organisms, Ecological distribution, Environmental effects, Biomass, Northern Ireland, Lakes, Water pollution effects, Invertebrates, Lough Neagh, Northern Ireland.

Benthic fauna of Lough Neagh, North Ireland, are not stable but are undergoing long-term changes as evidenced by sub-fossil records, and short-term changes as evidence in deeper waters (25 m) and more enriched areas. In the last century Tanytarsus has been replaced by Chironomus and that change will continue with C. plumosus replacing C. anthracinus, decreasing chironomid numbers, with perhaps Procladius becoming most abundant. Sampling took place at 2-4 week intervals from November 1974-November 1976 and was restricted to muddy lake sediments and Kinnego Bay, an almost enclosed bay substantially enriched by sewage effluent. Two main groups found at all sites are Chironomidea (Diptera) and Oligochaeta (mainly Tubificidae). Fauna are more restricted at greater depths with C. plumosus replacing C. anthracinus and tubificids, particularly Limnodrilus, more abundant. Procladius is the most common chrionomid in Kinnego Bay with C. plumosus and C. anthracinus. Fauna respond to increasingly difficult conditions in terms of oxygen depletion and nutrient enrichment. The average biomass of chironomids and tubificids is: 3.9 g sq m at eight m, 13.2 g sq m at 25 m, and 2.8 g sq m in Kinnego Bay. At eight m, C, anthracinus contributes 74% of the biomass; at 25 m, tubificids (Limnodrilus) contribute 74% and C. athracinus 15%; in Kinnego Bay, Limnodrilus contributes 40%, C. plumosus 38% and Procladius 20%. (Danovich-Wisconsin)
W80-01356

THE EFFECT OF SEWAGE ON UPTAKE OF INORGANIC NITROGEN AND CARBON BY NATURAL POPULATIONS OF MARINE PHYTOPLANKTON,
Biglow Lab. for Ocean Science, West Boothbay Harbor, ME.
J. J. MacIsaac, R. C. Dugdale, S. A. Huntsman, and H. L. Conway.
Journal of Marine Research, Vol 37, No 1, p 51-56, February 1979. 7 Fig, 5 Tab, 29 Ref. NSF GB-18568, BG-35880X, DEB 76-199 60 OCE 76-001 36

Descriptors: *Carbon, *Nitrogen, *Phytoplakton, *Sewage effluents, *Primary productivity, Nutrients, Nutrient requirments, California, Ammonium salts, Sewage, Poductivity, Carbon cycle, Nitrogen cycle, Growth rates, Kinetics, Mathematical studies, Nitrates, Photosynthesis.

Complex effects on phytoplankton from sewage effluent added to the sea through marine diffusers is shown in the study of two outfalls near Los Angeles and Santa Monica, California, March-April 1972. While sewage-generated N ultimately shouls stimulate primary production in this N-limited region, the study demonstrates that some sewage qualities actually impair N productivity; suppression of nitrate uptake is due to elevated ammonium levels and ammonium uptake suppression is caused by unspecified properties in the sewage itself. At low nutrient concentrations (one part effluent to 2,500 parts seawater), population responses are positive and very similar. However, at higher enrichments (one part effluent to 25 parts seawater), ammonium uptake in sewage is clearly suppressed. N and C uptake processes are independent; C uptake is relatively constant in comparison to changes in ammonium uptake. The ratio of C to N uptake is high when N supply is low, rapidly decreasing with the nutrient supply. Inhibition of ammonium uptake, and growth eventually, occurs when sewage-added ammonium levels are 10-100 microg-at 1; carbon uptake is reduced only at the highest level. Growth rate may be affected by much lower amounts of effluent than is carbon fixation and ammonium dependence may be forced even at very low effluent levels, possibly affecting phytoplankton species composition due to a single N source. (Danovich-Wisconsin)
W80-01357

DIURNAL DISTRIBUTION OF PHOTOSYNTHETIC PIGMENTS AND PLANKTONS IN RELATION TO ENVIRONMENTAL PARAMETERS IN THE MALAD CREEK, BOMBAY,
Central Inst. of Fisheries Education, Bombay (India).
O. P. Bohra, K. H. Ali, and S. N. Dwivedi.
Comparative Phsiology and Ecology, Vol 3, No 4, p 207-211, 1978. 19 Fig, 4 Tab, 4 Ref.

Descriptors: *Bombay, India, *Malad Creek, *Plankton, *Tidal effects, *Diurnal distribution, *Hydrobiology, Distribution, Primary productivity, Zooplankton, Phytoplankton, Chlorophyll, Chlorophyta, Copepods, Crustaceans, Dissolved oxygen, Tides, Transparency, Nutrients, Nitrates, Phosphates, Plant pigments.

Malad Creek, an estuary near Bombay India with 4.6 to 11.5 m water fluctuations, was investigated December 1976 for diurnal rhythm patterns of hydrobiological parameters. Tidal influence varies 0.62 m (1740 h) to 4.27 (2355 h) and minimum secchi disc reading is 33 m compared to a maximum 92 cm after high tide. Dissolved oxygen values fluctuate 0 to 7.459 ml; low values result from domestic and industrial effluents discharged into the estuary. Water is low in phosphate content (0.180-1.088 micro g at/1). Nitrate concentrations dominate with 30.0 micro g at/1 maximum and 2.75 micro g at/1 minimum. Silicate values range from 0.32 to 0.70 mg/1. Chlorophyta phytoplankton Ulothrix dominates; Navicula, Fragillaria, Coscinodiscus, Pleurosigma, and Nitzschia are also present. Maximum numbers (125,760/1) occur at 1600 hr and phytoplankton disappear at midnight, just after high tides. Total chlorophyll concentration ranges 12.0 to 66.64 mg/cu m and chlorophyll-a, the dominating pigment, varies 5.16 to 34.50 mg/cu m. Net and gross primary productivity values are 2.61 g C/cu m/d and 2.86 g C/cu m/d, respectiely. Total zooplankton numbers vary between 37 ind/1001 ko 385 ind/100 1. Zooplankton population is composed of Copepods and cladocera with Diaptomus dominating. (Danovich-Wisconsin)
W80-01358

ARTIFICIAL UPWELLING AND PHYTOPLANKTON PRODUCTION IN ALASKA,
Alaska Univ., Seward. Inst. of Marine Science.
A. J. Paul, J. M. Paul, and P. A. Shoemaker.
Marine Science Communications, Vol 5, No 1 p 79-89 1979. 1 Tab, 8 Ref.

Descriptors: *Primary productivity, *Alaska, *Phytoplankton, *Upwelling, Productivity, Diatoms, Growth rates, Subarctic, Fjords, Nutrients, Nutrient requirements, Fish management, Flow rates, Pumping, Thermocline.

Phytoplakton counts up to 35,000 cells/ml were artificially induced by flushing an Alaskan pond at a rate of 35% per day with nutrient rich seawater taken from below a subarctic fjord themocline. At flushing rates of only 2% per day, southcentral Alaskan spring bloom phytoplankton population levels could be artifically induced in a salt water impoundment. An Alaskan fjords annual primary production generally occurs during a short early spring bloom with cell counts averaging 1500 cells/ml. Following this bloom a thermocline develops, nutrients are depelted by plant growth, and summer fjord phytoplankton population density may decline to one cell/ml at a time when temperature is highest and if adequate food was available, the growth of filter feeders and grazers would be most rapid. However, nutrients are continually present below the thermocline and impoundment tidal power and wind and wave driven pumps are two mechanisms suggested for artificial upwelling. This 1977 experiment monitored phytoplankton growth in a 1,000,000 liter salt water pond flushed at a rate of 2% per day with sea water having NO2+NO3 levels of 12.5 micro g at/1 and P04

levels of 1.3 micro g at/l. After increasing flushing rates 10%, 20%, and 35% per day, phytoplankton cell counts increased to 7,8000, 20,000, and 35,000 cells/ml respectively, and this bloom was maintained for five months. The phytoplankton species occuring in the upwelling pond were the general Bacteriosira, Chaetoceros, Cylindrotheca, Skeletonema, Thalassiosira and various pennate diatoms. (Danovich-Wisconsin)
W80-01359

SPARTIAL VARIATION IN EPILITHIC ALGAE IN A STONY STREAM (WILFIN BECK) WITH PARTICULAR REFERENCE TO COCCONEIS PLACENTULA.
Freshwater Biological Association, Windermere (England).
J. G. Jones.
Freshwater Biology, Vol 8, No 6, p539-546, 1978 6 Fig, 1 Tab, 22 Ref

Descriptors: *Diatoms, *England, *Sewage effluents, *Streams, *Distribution, Algae, Standing crops, Flow, Effluents, Phytoplankton, Sewage, Agricultural runoff, Farm wastes, Surface wastes, Population, Chyrsophyta, Periphyton, Seasonal, Distribution patterns, Ecological distribution, Rainfall.

Water flow, as measured by rainfall, has a marked effect on epilithic algae numbers 1973-1974 in Wilfin Beck, a stony English stream; mean Cocconeis placentula counts decrease with increasing rainfall. This paper examines epilithic algae distribution in the stream with epifluorescence techniques. The stream receives organic enrichment from a trickling filter sewage treatment plant and grazing cattle. Sewage effluent normally contains one mg/l soluble reactive phosphorus, 1.2 mg/l ammonia, and eight mg/l nitrates. Immediately below the outfall, a sewage fungus community comprised of Sphaerotilus natans occurs; stalked ciliates dominate. During summer, encrusting red algae Hildenbrandtia rivularis and juvenile Batrachospermum stages are observed encrusting green and blue-green algae, particularly Oscobyssa rivularis, are also more frequent in downstream outfall areas. Clean surfaces placed above and below the discharge show significantly higher Cocconeis cell numbers below the outfall. Cocconeis counts below sewage outfalls tend to be highest in autumn whereas other diatom counts are highest in spring. Grazing cattle have marked effects on water chemistry, and for short periods, on epilithic flora composition. A clear increase in Cocconeis colonization rates from 12,950 to 30,060 cells/sq cm/d occurs up to a certain grade of stone roughness. Results are extremely variable and apart from nutrient input effects Cocconeis standing crops are largely related to water flow rates. (Danovich-Wisconsin)
W80-01360

LIFE-HISTORY AND DISTRIBUTION OF SIMULATION AUSTENI (DIPTERA, SIMULIIDAE) IN RELATION TO PHYTOPLANKTON IN SOME SOUTHERN ENGLISH RIVERS.
Freshwater Biological Association, Wareham (England). River Lab.
R. G. Hansford.
Freshwater Biology, Vol 8, No 6, p 521-531, 1978. 5 Fig, 6 Tab, 31 Ref

Descriptors: *England, *Diptera, *Distribution, *Rivers, *Life history studies, *Public health, Diatoms, Phytoplankton, Speciation, Growth stages, Seasonal, Productivity, Population, Competition, Ecological distribution, Distribution patterns, Algae, Larvae, Larval growth stages, Aquatic insects.

Simulium austeni, a univoltine man-biting species, is characteristic of the weedy middle and lower reaches of the Stour River, near Dorset, England; however, its distribution does not correlate well with phytoplankton availability, which varies considerably year to year. This February 1973 to May 1975 study examines the life-history and larvae distribution of this species which first created a problem in the 1960s and became worse around 1971. The Stour River is unpolluted and has a 95 km total length and 25-30 m maximum width. Nine Simulium species were recorded: S. austeni produces a single pupae peak from mid-April to mid-May each year, while other species have three generations per annum. S. austeni competes larval development prior to mature early summer larval production by multivoltine species, thus avoiding competition with them. Stephanodiscus hantzschii, which has reached high concentrations since 1948, the most abundant spring diatom, reached 37,000 cells/ml in April 1973 and even higher levels in May, 1975. Phytoplankton are rarely present for the entire S. austeni larval development period. Stour tributaries supporting S. austeni have relatively low suspended algae concentrations. Elsewhere in the area, S. austeni is rarely numerically dominant and is often uncommon. Simulid species distribution with respect to water chemistry is poorly understood, however, Stour nitrate concentrations have doubled in the last decade. (Danovich-Wisconsin)
W80-01361

THE BIOLOGY OF CANADIAN WEEDS 34. MYRIOPHYLLUM SPICATUM L.
Minnesota Univ., St. Paul. Dept. of Botany.
For primary bibliographic entry see Field 4A
W80-01362

A REVIEW OF THE LITERATURE ON SEDIMENT-WATER EXCHANGE OF NITROGEN COMPOUNDS.
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
L. Kamp-Nielsen, and J. M. Andersen.
Progress in Water Technology, Vol 8, No 4-5, p 393-418, 1977. 1 Fig, 3 Tab, 59 Ref

Descriptors: *Sediments, *Nitrogen, *Sediment-water interfaces, *Nitrogen cycle, *Reviews, Lakes, Soils, Ammonia, Nitrogen fixation, Nitrification, Denitrification, Nutrient transport, Cycling nutrients.

This literature review illustrates that while much information exists regarding sediment-water exchange of nitrogen compounds and the influence of environmental parameters, knowledge is lacking on the relative importance of various processes in nitrogen transformation in sediments. Information on the nitrogen cycle is needed if predictions are to be made on consequences of alterations in nitrogen loading to water bodies. The review concentrates on lakes because their relention time is long compared with river systems. Research on nitrogen exchange has followed two directions: work with undisturbed sediment cores, and work with mixed sediment-water systems. Combining the two methods by system analysis and the development of realistic models of the exchange processes are suggested for further research. Nitrogen in the upper layers of the sediment is both organic and inorganic. Annual gross sedimentation rates of nitrogen range 3.5 g N sq m to 30 g N sq m. The primary nitrogen cycling process in sediments is degradation and mineralization of organic matter. The major pathway for ammonification in lake sediments is bacterial cycling. Ammonia liberation rates vary from 3.4-13.7 mg ammonia/sq m/d in Danish lakes to 73 mg ammonia/sq m/d in Lake Trummen, Sweden. Nitrogen fixation, nitrification, denitrification, and rate limiting processes for nitrogen exchange in natural waters are also discussed. (Danovich-Wisconsin)
W80-01363

POLLUTANS LOADINGS IN URBAN STORM WATER.
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 5B
W80-01364

A POSSIBLE CORRELATION BETWEEN ALGAL NUMBER AND S. GALILAEUS YIELD IN THE KINNERET.
Hebrew Univ., Jerusalem (Israel). Dept. of Zoology.
K. Retch.
Bamidgeh, Bulletin of Fish Culture in Israel, Vol 30, No 4, p 126-127, 1978. 1 Fig, 1 Tab, 1 Ref

Descriptors: *Lake Kinneret (Israel), *Algae, *Fish food organisms, *Fish populations, Correlation analysis, Biomass, Growth rates, Nutrient requirements, Fish, Fish harvest, Fish diets.

Comparison of Sarotherodon galilaeus catch fluctuations and annual algal biomass fluctuations in Lake Kinneret, Israel, from 1969 to 1977 reveals no correlation, but a parallel nevertheless exists between periodicity algal quantities and S. galilaeus catch; after 1969 years S. galilaeus catch is a function of algal biomass primarily during its hatching. Since catches consist mainly of second-year-old fish, its number is determined by algal biomass two years previous. However, fluctuations in algal biomass and fish numbers may be induced by some primary factor such as water temperature, rainfall, nutrients, or water losses. Even if correlation between the two phenomena is not consistent, long term periodic and trend annual algal numbers serve as a basis for predicting S. galilaeus catches two years later. (Danovich-Wisconsin)
W80-01365

ASPECTS OF CO2-FIXATION IN SOME FRESHWATER RHODOPHYCEAE.
Cologne Univ. (Germany, F. R.). Botanisches Inst.
B. P. Kremer.
Phycologia, Vol 17, No 4, p 430-434, December 1978. 4 Fig, 1 Tab, 21 Ref

Descriptors: *Rhodophyceae, *Photosynthesis, *Temperature, *Freshwater, Algae, Aquatic algae, Biochemistry, Light, Carbon dioxide, Plant physiology, West Germany, Ecological distribution, Adaptation.

The soluble carbohydrates floridoside and isofloridoside show increasing C14 uptake over time and, therefore, are the main working end products of photosynthetic carbon reduction in freshwater Rhodophyceae collected from habitats near Cologne, West Germany. This autoecologically specialized group of red algae lives within three marine species, which exclusively accumulate either floridoside or isofloridoside regardless of the salinity under their habitats prevail. The algae assimilate rates of red freshwater algae Compsopogon coeruleus, Batrachospermum helminthosum, and Lemanea annulata as in light but these resemble marine Rhodophyceae with optimal assimilation to temperature conditions and many accumulation products of photosynthesis, mainly isofloridoside. Compsopogon coeruleus optimal photosynthetic rates at temperatures between 4C and 40C, a maximum at 35C, decreasing abruptly at temperatures exceeding 40C. The maximum rate of light dependent C assimilation in Lemanea annulata is a 25C, decreasing rapidly at temperatures above 30C. The widespread occurrence C. coeruleus and native L. annulata may be regarded as freshwater red algae types adapted to different temperature habitats. Dark uptake of inorganic carbon does not exceed 3% of the photosynthetic organic potential, contributing significantly less to the total carbon balance than assimilations of Phaeophyceae. (Danovich-Wisconsin)
W80-01366

NITRATE UPTAKE BY LAMINARIA LONGICRURIS (PHAEOPHYCEAE).
Rhode Island Univ., Kingston. Dept. of Botany.
M. M. Harrison, and J. S. Cobb.
Journal of Phycology, Vol 14, No 4, p 484-487, December 1978. 3 Fig, 13 Ref

Descriptors: *Nitrate, *Transporting, *Nutrient requirements, *Kelps, Aquatic algae, Algae, Nitrogen, Kinetics, Nitrate, Nutrients, Temperature, Light, Plant physiology, Biochemistry, Ammonia, Canada, St. Margaret's Bay, Nova Scotia.

Laminaria longicruris collected in St. Margaret's Bay, Nova Scotia, Canada, July-August 1974 and February 1976, accumulates nitrate under nitrate conditions thus supplementing internal N reserve

and sustaining growth after nitrate sea water concentrations have declined to low summer levels. This investigation of nitrate uptake from the water column by Laminaria looked at effects of nutrient concentrations, light levels, and temperatures within the range normally encountered. Nitrate uptake summer rates decline with decreasing temperature, but even at 0C, the rate is 30% of the 15C rate, 6.4 micromol h gDw. Laminaria scavenges nitrate from solutions with 0.5 micro M. The winter adapted tissues uptake rate in light at 0 C is 2.0 micromol h G Dw, almost 50% of that measured at 10C. Rates measured in darkness preceeded by light period are similar to control rates (1.9 micromol h g Dw at 0C), but if tissue is in darkness for 15 h the uptake rates but does not abolish them. Nitrate uptake is not suppressed by ammonia, even when the latter is present at 100 micro M for six h. Laminaria pretreated with antibiotics for five to 12 h are 97% and 88%, respectively, of the control nitrate uptake rates in light at 15C. Increasing the ratio of nitrate: nitrite causes increasing supression of nitrite uptake. (Danovich-Wisconsin)
W80-01367

VERTICAL AND SEASONAL VARIATION OF PHTOPLANKTON PHOTOSYNTHESIS IN A BROWN-WATER LAKE WITH WINTER ICE COVER,
Helsinki Univ. (Finland). Dept. of Botany.
R. I. Jones, and V. Ilmavirta.
Freshwater Biology, Vol 8, No 6, p 561-572, December 1978. 5 Fig, 2 Tab, 33 Ref.

Descriptors: *Phytoplankton, *Lakes, *Photosynthesis, *Succession, *Lake Paajarvi, Finland, On-site tests, Ice cover, Iced lakes, Light, Temperature, Biological communities, Plankton, Distribution, Seasonal, Environmental effects, Primary productivity, Adaptation, Ecological distribution.

Within limits imposed by prevailing environmental conditions, the amount of phytoplankton present in Lake Paajarvi, southern Finland, May 1976-May 1977, is the most important determinant of absolute photosynthetic rates. Photosynthetic capacity differences, whether due to adaptation of species composition alterations, are only of secondary importance. Lake Paajarvi, with 14.4 mean depth, is ice covered 140 d yr, has high dissolved organic content of 50 mg Pt l, and eutrophic zone restricted to the upper most 4 m. Phytoplankton do not show great adaptation to changing irradiance. Maximization of photosynthetic production is achieved by altering phytoplankton community composition, so that a steady algal species succession is observed through the year each one adapted to prevailing conditions. The chlorophyll content per unit algal volume does fluctuate, being lowest in summer (1-2.5 mg chl-a cu m) and highest after the long period of ice cover (5.5-7.2 mg chl-a cu m). The absence of a marked vertical photosynthetic capacity differentiation is attributed to the steep light gradient. Deep-water algae show photosynthetic rates per unit chlorophyll-a equivalent to or greater than those of upper-water algae, implying high algal sedimentation rates and low residence time. (Danovich-Wisconsin).
W80-01368

GROWTH RESPONSE OF ANABAENA FLOS-AQUAE (LYNGB.) DEBREBISSON IN WATERS COLLECTED FROM LONG LAE RESERVOIR, WASHINGTON,
Corvallis Environmental Research Lab., OR.
T. Shiroyama, W. E. Miller, and J. C. Shigihara.
In: Proceedings: Symposium on Terrestial and Aquatic Ecological Studies of the Northwest; March 26-27, 1976. Eastern Washington State College Press, Cheney, Washington. p 267-275. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Algal assay bottle test, *Cyanophyta, *Zinc, *Eutrophication, *Mine wastes, *Growth rates, Bioassay, Analytical techniques, A. flos-aquae, Long Lake(WA), Spokane(WA), Spokane River(WA), Seasonal, Coeur d' Alene River(WA), Phosphorus, Industrial wastes, Leaching, Impoundments, Laboratory tests, Washington, Anabaena.

In a laboratory investigation utilizing the standard algal assay bottle test, growth variations of the filamentous nitrogen-fixing blue-green alga Anabaena flow-aquae taken from eutrophic Long Lake, Washington were shown to result from zinc toxicity from smelter waste discharge and leaching of old mine tailings upstream in the Spokane - Coeur d' Alene River system. The lake, an impoundment of the river, has undergone water quality deterioration both from effluents of Spokane's municipal primary sewage treatment plant and from about 80 years of heavy metal inflow through the basin system. The cyanophyte failed to grow in unchelated water samples taken May 12-July 1 and in November, possibly a result of seasonal high flow of the Spokane River accompanied by high metal concentrations. Samples collected July 15-August 12 produced significant algal growth. During this period, phosphorus was determined as limiting. Heavy metals other than zine may have been responsible for significant biomass drops in samples collected August 25-September 10 and September 23-October 21. Addition of EDTA to all water samples promoted a universal increase in biomass production, an in most samples raised A. flos-aquae growth to predicted levels as determined by phosphorus analysis. (Harris-Wisconsin)
W80-01369

USE OF ALGAL ASSAYS TO ASSESS THE EFFECTS OF MUNICIPAL AND SMELTER WASTES UPON PHYTOPLANKTON PRODUCTION,
Corvallis Environmental Research Lab., OR.
J. C. Greeene, W. E. Miller, T. Shiroyama, R. A. Soltero, and K. Putman.
In: Proceedings: Symposium on Terrestial and Aquatic Ecological Studies of the Northwest; March 26-27, 1976. Eastern Washington State College Press, Cheney, Washington, p 327-336. 5 Fig, 1 Tab, 11 Ref.

Descriptors: *Algal assay bottle test, *Municipal wastes, *Zinc, *Phytoplankton, *Toxicity, *Mine wastes, Bioassay, Analytical techniques, Waste water treatment, Standing crops, Eutrophication, Biomass, S. Capricornutum, Long Lake(WA), Spokane(WA), Spokane River(WA), Lake Coeur d' Alene(WA), Phosphorus, Nitrogen, Cycling nutrients, Industrial wastes, Leaching, Impoundments, Laboratory tests, Washington, Idaho.

The standard algal assay bottle test shows the indigenous phytoplankton standing crop in Long Lake, Washington is not affected by zinc carried in by the Spokane River from smelter waste discharges and leaching of old mine tailings in the upper reaches of the Lake Coeur d' Alene drainage basin. However, test results to show the standing crop (S. capricornutum) is limited by phosphorus and nitrogen affected mainly by effluent from Spokane's municipal primary sewage treatment plant, comprising about 0.4% of the river's flow below the discharge point. The lake, an impoundment of the river, has undergone water quality deterioration, but approximately 80 years of heavy metal inflow throughout the basin system has probably affected species composition if not productivity. Each Long lake test station was sampled individually. Water samples were collected from the surface to the lower limit of the euphotic zone, usually at 1-2 m intervals. Zinc was analyzed on an atomic absorption spectrophotometer; lake waters without nutrient or chelator additions served as controls. The assay revealed that Long Lake is primarily nitrogen-limited for phytoplankton growth in 57% of the samples. Phosphorus was limiting in 30% of the samples and either nutrient in 13%. (Harris-Wisconsin)
W80-01370

THE DIATOMS OF CONTEMPORARY AND ANCIENT SEDIMENTS FROM LAKE WAIAU, AND THEIR GEOCHEMICAL ENVIRONMENT,
Hawaii Univ., Honolulu. Dept. of Botany.
J. E. Massey.
Review of Paleobotany and Palynology, Vol 27, No 1, p 77-83, 1979. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Diatoms, *Lake Maiau(HA), *Sediments, *Cores, *Paleolimnology, *Geochemistry, Population, Speciation, Hawaii, Sampling, Geologic time, Ecology, Quaternary period, Regression analysis, Equations, Soil chemistry, Chemical analysi.

Eight diatom species occur in core sediments taken from Lake Waiau, Hawaii: Nitzchia frustulum, Nitzschia vitrea, Achnanthes hauckiana, Navicula radiosa, Hantzchia amphioxys Cocconeis placentula, Melosira italica, and a new specis, Stauroneis maunakeaensis. Lake Waiau, a heart-shaped water body with one ha area and three m maximum depth, is located at 3969 m on Mauna Kea, an extinct volcano. Bottom sediments cores contain diatom frustules spanning a 5000 yr period. All ancient diatom species, except Stauroneis, are heteromorphic, cosmopolitan forms. The two Nitzschia species are found throughout the two m core. H. amphioxys and C. placentula aren't found throughout contemporary sediments; however, five additional species are present: Navicula divergens, Amphora costata, S. kriegeri, Fragilaria lapponica, and Rhopalodia musculus. Between 70-140 cm, marked fluctuations in N. frustulum populations occur; three other species also appear briefly. The most recent 38 cm layers reflect human influences. Comparing core and contemporary sediments, the following chemical changes are observed: increases in Mn and Ca concentrations, decreases in Na, K, P, Si, Al, Fe, and no changes in Mg and Ti contents. When potassium (Kx and aluminum levels rise, N. frustulum population declines; high K levels, 15 micro g-at/g sediment, alone produces this response. N. vitrea populations exhibit acute sensitivity to unusually high phosphorus concentrations (4.8 micro g-at/g sediment) reflecting phosphate effects on essential trace metal availability. (Danovich-Wisconsin)
W80-01371

RADON-222 IN POTABLE WATER SUPPLIES IN MAINE: THE GEOLOGY, HYDROLOGY, PHYSICS AND HEALTH EFFECTS,
Maine Univ. at Orono. Land and Water Resources Center.
C. T. Hess, S. A. Norton, W. F. Brutseart, R. E. Casparius, and E. G. Coombs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116304, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, September, 1979. 119 p, 25 Fig, 19 Tab, 31 Ref, Append. OWRT A-045-ME(2).

Descriptors: *Gases, *Water pollution sources, *Groundwater, Domestic water, Maine, Potable water, Water supply, Water quality standards, Water analysis, *Radon-222, Health effects.

Objectives were: (1) to obtain up to 2000 samples of groundwater and to measure them using a new inexpensive liquid scintillation technique; (2) to collect 350 samples of water from drilled wells, private water supplies, and some public water supplies to determine their physical, chemical, and geological characteristics in order to describe the geographic distribution of areas of high radon; (3) to determine levels of radon gas in the environment of ten sample homes; to describe the type of housing and level of radon in their respective water supplies; (4) to prepare a map showing the distribution of sample points with radon levels; (5) to calculate the statistical association of radon with cancer; (6) to provide a scientific basis for setting a state drinking water standard for radon; and (7) to make recommendations for further study. Preliminary conclusions: (1) radon is present in much of Maine's water supplies in excessive amounts; (2) radon concentrations are highest in granite formations; (3) public utility water supplies have substantially lower radon levels than do private wells; (4) levels of radon gas in home air exceed recommended levels and result in a dose rate associated with high risk in industrial settings; (5) levels of radon are highly correlated with some types of cancer, especially of lung and reproductive systems; and (6) a domestic water supply standard of 10,000 pCi/l is recommended to yield dose rates or mortality rates that would not exceed national averages.
W80-01378

COMMUNITY INTERDEPENDENCE AND ENVIRONMENTAL QUALITY: PROBLEMS IN MANAGING NON-POINT POLLUTION,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
For primary bibliographic entry see Field 6E.
W80-01380

ISOLATION OF PATHOGENIC NAEGLERIA FROM ARTIFICIALLY HEATED WATERS,
Oak Ridge National Lab., TN.
R. L. Tyndall, E. Willaert, A. R. Stevens, and C. C. Coutant.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-770961-3, Price codes: A02 in paper copy, A01 in microfiche. (1977) 2 Fig, 5 Tab, 13 Ref.

Descriptors: *Electric powerplants, *Heated water, *Water temperature, *Pathogenic bacteria, Florida, Texas, Tennessee, Thermal pollution, Temperature, Water cooling towers, Water pollution sources, Microorganisms, Environmental effects, Human pathology, Diseases, Effluents, Public health.

Artificially heated waters may facilitate propagation of pathogenic, free-living amoeba as shown from water samples collected in summer 1976 near power plant discharges in Florida and Texas and from cooling towers in Tennessee. Water temperatures range 25 to 41C. Waters receiving thermal discharge from electric power plants were studied to determine whether there is increased pathogenic free-living amoeba proliferation. Water samples were also taken from several lakes not associated with power plants; these water temperatures range 30 to 34C. Some water samples receiving power plant effluent show amoeba growth at 45C and some mice inoculated with amoeba isolates died within 4-10 days. The amoeba was identified as Naegleria due to their ability to grow at 45C, transform into flagellates, and produce primary amebic meningoencephalitis (PAME) in mice. The amoeba were confirmed as N. fowleri by antiserum tests. Two of five Florida power plant effluent sites are positive for N. fowleri whereas control lakes are devoid of the amoeba. Only one of 11 Texan sampling sites yielded pathogenic N. fowleri. Although Oak Ridge, Tennessee, cooling towers were negative for N. fowleri, amoeba identified as Acanthamoeba grew from all 37C samples. Pathogenic free-living amoeba in heated water poses public health problems in areas used for recreational purposes. (Danovich-Wisconsin).
W80-01390

WATER QUALITY AND URBAN STORMWATER: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management
For primary bibliographic entry see Field 4C.
W80-01399

DISTRIBUTION OF INTERTIDAL DIATOMS ASSOCIATED WITH SEDIMENTS IN YAQUINA ESTUARY, OREGON,
Oregon State Univ., Corvallis, Dept. of Botany and Plant Pathology.
M. C. Amspoker, and C. D. McIntire.
Journal of Phycology, Vol 14, No 4, p 387-395, December 1978. 4 Fig, 5 Tab, 46 Ref. NSF DES 72-01412 A01.

Descriptors: *Diatoms, *Distribution, *Intertidal areas, *Salinity, *Sediments, *Mathematical studies, *Estuarine environment, *Yaquina Estuary, Newport(OR), Estuaries, Oregon, Distribution patterns, Environmental gradient, Numerical analysis, Correlation analysis, Light, Plankton, Brackish water, Freshwater, Sea water, Ecological distribution.

The paper presents quantitative and qualitative analysis of sediment-associated diatom assemblages along horizontal, vertical, and seasonal environmental gradients in Yaquina Estuary near Newport, Oregon, November 1973 to August 1974. Diatom distribution is regulated primarily by mean sediment size and salinity; however, half the diatom flora numerical variation was related to factors other than the measured physical and chemical parameters. Diatom flora is mostly continuous but in some cases it is patchy. At 5% mean salinity, a relatively sharp discontinuity occurs in the diatom flora which represents biochemical and biophysical mechanisms involved in osmotic regulation of fresh- and brackish water diatoms. Stochastic processes, biological interactions, such as grazing, amensalism, and competition for suitable substrata, and physiological tolerance of the fluctuating estuarine environment must influence population dynamics and community structure. The sediment-associated diatom flora are dissimilar in species composition to epilithic, epiphytic, and planktonic assemblages in Yaquina estuary. Approximately 36,500 diatom cells were identified representing 61 genera; the largest number belong to genera Navicula, Nitzschia, Achnanthes, Amphora, and Cocconeis. Species diversity is high while redundancy is low. There is no conspicuous distributional pattern associated with season or intertidal height. (Danovich-Wisconsin)
W80-01436

SEDIMENTS OF LAKE ROTORUA AS SOURCES AND SINKS FOR PLANT NUTRIENTS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div
E. White, B. J. Don, M. T. Downes, L. J. Kemp, and A. L. MacKenzie
New Zealand Journal of Marine and Freshwater research, Vol 12, No 2, p 121-130, June 1978. 5 Fig, 7 Tab, 16 Ref.

Descriptors: *Cycling nutrients, *Anaerobic conditions, *Lake sediments, *Nutrient loading, *Chemical analysis, Sediments, Sediment-water interfaces, Phosphorus, Lakes, Nitrogen, Water pollution sources, Eutrophication, New Zealand, Nutrients, Nutrient budgets.

Nutrients released from anoxic sediments in Lake Rotorua, New Zealand, were estimated at 20-40 mg P.sq m/d and 250-350 mg N sq m/d; however, deoxygenation was slight compared with 1969-1970 and 1974-1975. If reducing conditions affected 60% of the lake bottom over 13 days, the released nutrients would amount to 25-50% of those added annually from other sources. Quantitative estimates were made of nutrients released from the sediments in order to compare them directly with other nutrient sources. Lake Rotorua, with a mean depth of 10.7 m and an 81 sq km area is a eutrophic lake with a chlorophyll a content of 4.5-47.0 mg/cu m. The Rotorua urban area has a 47,000 population. In 1973 a new activated sludge sewage treatment plant replaced septic tank systems. The phosphorus level in 1975 increased to 47 kg/d from the 1960 level of 12 kg/d and the nitrogen level in 1975 increased to 290 kg/d from the 1960 level of 75 kg/d. In mid-January 1976 calm weather produced anaerobic conditions for six days. The reduced sediment condition produced a spectacular increase in mean nutrient concentrations. The dissolved reactive phosphorus was 4.0 mg/cu m and inorganic nitrogen was 50 mg/cu m corresponding to and increase of 3100 kg phosphorus and 39,000 kg ammonia-nitrogen. (Danovich-Wisconsin)
W80-01441

NITROGEN AS A GROWTH FACTOR IN FRESHWATER,
National Swedish Environment Protection Board, Uppsala. Inst. of Physiological Botany
C. Forsberg.
Progress in Water Technology. Vol 8, No 4-5, p 275-290, 1977. 3 Fig 1 Tab, 99 Ref.

Descriptors: *Nitrogen, *Freshwater, *Plant growth, *Trophic level, *Phytoplankton, *Limiting factors, Algae, Aquatic plants, Eutrophication, Oligotrophy, Mesotrophy, Organic compounds, Inorganic compounds, Waste water treatment, Nutrient removal, Ammonium, Nitrates, Vitamins, Ultra-oligotrophy, Absorption, Nutrients.

A survey of the role of nitrogen in freshwater plant growth, emphasizing phytoplankton, indicates that in strongly eutrophic waters resulting from sewage pollution, nitrogen is a more important growth-limiting nutrient than phosphorus. In less eutrophic and mesotrophic waters the two nutrients exert about equal control, while in oligotrophi lakes phosphorus is often dominant. Examples are presented, however, in which nitrogen is a limiting nutrient in ultra-oligotrophic lakes. Nitrogen concentrations in natural waters vary from very low values to several mg/l. Ammonium and nitrate are most often preferred by water plants, but such organic compounds as amino acids, amides, urea, and uric acid are also suitable nitrogen sources. As a vitamin constituent, nitrogen is a factor in the growth of auxotrophic organisms, and as a constituent or organic compounds with chelating capacity, it can indirectly support their growth. Nitrogen content in aquatic plants ranges 1-10% of dry matter. Luxury uptake of nitrogen or phosphorus causes large variations in the N:P ratio. Analyses of tissues to estimate minimum nutrient content necessary for growth indicate a critical N:P ratio of 10:1. Additional research needs are also described. (Lynch-Wisconsin)
W80-01442

PHYTOPLANKTON COMMUNITIES IN UPWELLING AREAS. THE EXAMPLE OF NW AFRICA,
Barcelona Univ (Spain). Dept. of Ecologia.
R. Margalef
Oecologia Aquatica, No 3, p 97-132, July 1978. 15 Fig, 12 Tab, 53 Ref.

Descriptors: *Phytoplankton, *Upwelling, *Distribution patterns, *Atlantic Ocean, Distribution, Biological communities, Circulation, Movement, Population, Dinoflagellates, Nutrients, Adaptation, Hydrodynamics, Light, Light intensity, Flow currents(Water), Mixing, Turbulence.

Data from late summer 1971 and spring 1975 cruises off northwest Africa show that phytoplankton community population sequences, representing ecological succession, develop around a core of maximum water movement. Diatoms are the most important characteristic upwelling organisms and primary production is maximal in central upwelling areas, however, production is also important in peripheric areas with large diatoms. Thalassiosira and Phaeocystis speices located close to upwelling core areas are often covered by mucilage. Around the core species, populations involve diatoms such as Nitzchia, Chaetoceros, and Rhizosolenia, of rather large individual cell size. Water speed, nutrient concentration, and light use and penetration are decisive in establishing definite distribution layers. Hydrodynamics, which explains funnelling and energy concentration in particular spots and how water movement breaks down into cells, is essential in understanding phytoplankton distribution patterns. In spring, upwelling intensification blows apart the whole structure; large diatom populations adopt peripheric or concentric positions in relation to maximum nutrient outflow. Dinoflagellates develop in large numbers in moderate upwelling areas, but populations disperse in stronger flow seasons. Thermic conditions affect Hemicaulus, Asterinonella glacialis, and Amphora hyalina diatom distributions, but mechanical factors and associated nutrient inflow determine entire distribution patterns. (Danovich-Wisconsin)
W80-01443

DISTRIBUTION OF PHYTOPLANKTON IN ARKANSAS LAKES,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
J. W. Holgert, F. A. Morris, M. K. Morris, W. D. Taylor, and L. R. Williams
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-292742, Price codes: A04 in paper copy, A01 in microfiche. EPA-600/3-78-101, December 1978. 53 p, 3 Tab. 12 Ref, 2 Append.

Descriptors: *Distribution, *Arkansas, *Lakes, *Phytoplankton, *Systematics, *Baseline studies, Eutrophication, Water quality, Trophic level, Speciation, Computers, Bioindicators, Indicators, Water polltuion, Organic loading, Sewate ef-

fluents, Organic waters, Sewage, Data storage and retrieval, Data processing.

This report presents a computerized inventory of phytoplankton species aand abundance in 16 Arkansas lakes and results of several biological indices of water quality and community structure during 1974. Data biologically characterizes the lakes and will be used as baselines for future investigations. Sampling was part of a National Eutrophication Survey and was limited to lakes impacted by municipal sewage treatment plant outfalls, 40 ha or larger in size, and mean retention time at least 30 days. Lakes are sampled under spring, summer, and fall conditions. Nygaard's Trophic State, Palmer's organic Pollution and species diversity and abundance indices are also included. Dominant phytoplankton in Beaver Lake are Chroomonas acuta and Melosira diatoms. Nygaard's index shows the lake is eutrophic and Palmer indicates high organic loads in August whereas April and October loads are low. Chroomonas acuta, Melosira distans and Skeletonema potamos are dominant in Lake Catherine. Crytomonas erosa and Melosira distans are domninat in Lake Chicot. The lake is eutrophic and high organic pollution occurs in August; organic pollution loads are low in March and October. Grand Lake is eutrophic and has an extremely high organic pollution head during the entire year; dominant phytoplankton include Stephanodiscus astrea v. minutala and Dactylococcopis. (Danovich-Wisconsin)
W80-01444

THE EFFECTS OF BRIEF PERIODIC SUBMERGENCE OF INTERTIDAL FUCOID ALGAE,
Glasgow Univ., (Scotland). Dept. of Botany.
M. Schonbeck, and T. A. Norton.
Estuarine and Coastal Marine Science, Vol 8, No 3, p 205-211, April 1979. 4 Tab, 11 Ref.

Descriptors: *Intertidal areas, *Nutrients, *Algae, *Phaeophyta, Ecology, Scotland, Coasts, Growth rates, Tides, hajbitats, Productivity, Nutrient requirements, Light, Drying, Niches, Water level fluctuations, Algal growth potential, Water levels, Marine algae.

In 1975 in-situ and culture experiments of three intertidal algal species taken from the Isle of Cumbrae, Scotland, Fucus spiralis and Pelvetia canaliculata differed from the lower shore Fucus serrarus in that they only grew quite rapidly when submerged for only short periods. The paper investigates the possibility that nutrient scarcity, dissolved inorganic carbon, or aerial conditions control inter-tidal seaweed upper limits. Samples were collected in summer and winter, 1975. The linear growth of F. spiralis in-situ plants changed from 22.1 mm mo to 10.5 mm mo towards the top of their usual habitat zone and P. canaliculata plants grew 4.9 mm mo at the same height as compared to their maximum rate of 7.1 mm mo. Reduced winter growth reflects very low solar irradiance conditions. All plants grow under simulated tidal regimes and P. canaliculata and F. Spiralis grows almost as rapidly in length and weight when submerged only one hr per 12 as they dor for 11 hr. F. serratus grows progressivley faster with increasing submersion time at rate of 12.5 mm mo and 23.2 mm mo for one hr and 11 hr cycles, respectively. F. spiralis and P. canaliculata grow slowely when submerged only four hr cycles, respectively. F. spiralis and P. canaliculata grow slowly when submerged 20 hr d. P. canaliculata and F. spiralis also grow very slowly when submerged only four hr d in dilute nutrient medium, but growth increases in full nutrient culture medium. Both species require lower nutrient concentrations when submerged 20 hr d. P. canaliculata and F. spiralis also grow very slowly when exposed to air during the light period, and more rapidly when sumberged during the light period. (Danovich-Wisconsin)
W80-01445

NITROGEN AS LIMITING FACTOR FOR THE GROWTH OF THE BLUE-GREEN ALGA OSCILLATORIA AGARDHII,
Amsterdam Univ. (Netherlands). Lab. for Microbiology.
L. Van Liere, W. Zavenboom, and L. R. Mur.
Progress in Water Technology, No 4-5, Vol 8, p 301-312, 1977. 7 Fig, 2 Tab, 30 Ref.

Descriptors: *Nitrogen, *Cyanophyta, *Growth rates, *Nutrient kinetics, *Pigments, Oscillatoria agardhii, Gomont, Limiting factor, Physiological ecology, Laboratory tests, Chlorophyll, Algae, Biochemistry.

Growth of the Cyanophyte Oscillatoria agardhii followed Menten-Michaelis kinetics under limited nitrate supply in laboratory tests, and there were large differences between batch-growth and continuous-culture specimens for both measured parameters: specific growth rate constant and half-saturation constant. At higher light intensities chlorophyll-a and C-phycocyanin were lowered, but total carotenoid content did not change. A decrease of chlorophyll-a and C-phycocyanin during the cessation of growth indicates these pigments may function as a nitrogen reserve in the growth processes after nitrogen depletion. Growth rate and incident light intensity both influenced pigmentation of the alga. Nitrogen-starved cells or batch cultures and nitrogen limited chemostat cultures were used to study the influence of nitrogen on organism growth. Determination of the half-saturation constant and the maximum value of the specific growth rate constant in chemostats, with organisms that are adapted to low limiting concentrations are considered the best way to understand the role of nutrient concentrations. (Danovich-Wisconsin)
W80-01446

NITROGEN FIXATION-A REVIEW OF THIS PHENOMENON AS A POLLUTING PROCESS,
Californai Univ., Berkeley. Sanitary Engineering Research Lab.
A. J. Horne.
Progress in Water Technology, Vol 8, No 4-5, p 359-372, 1977. 1 Tab, 53 Ref.

Descriptors: *Nitrogen fixation, *Water pollution, *Eutrophication, *Cyanophyta, *Pollution abatement, *Chemical control, Nitrogen, Watersheds, Metabolism, Nuisance algae, Trophic level, Aquatic productivity, Nitrogen cycle, Lakes, Clear Lake(CA), Southern Basin, Windermere, United Kingdom, Lentic environment, Estuaries, Salt marshes, Homeostasis, Oligotrophy, Mesotrophy, United Kingdom.

Nitrogen fixation can sometimes but not always supply all the nitrogen for eutrophication if phosphorus is supplied. Nitrogen fixation is part of the polluting process under two conditions: (1) original rates are increased by addition of other substances such as phosphorus, iron, erosion, or sewage, and natural rates change the water body from oligo- or mesotrophic to a eutrophic condition; (2) if nitrogen fixation maintains a highly eutrophic state. This literature study focuses on measurements of nitrogen fixation over several years in water bodies and recommends use of chemical compounds that effect blue-green algal metabolism. Nitrogen fixation causte 30-50% of this lakes annual nitrogen income whereas sediment bacterial nitrogen fixation is low. At the southern Basin of Windermere, U.K. nitrogen fixation is important to nitrogen income of individual algal but not to the whole lake nitrogen inflow. The role of nitrogen fixation is not important in river environments except when a river flows into nitrogen-depleted reservoirs or lakes. Values of nitrogen fixation in open estuarine waters or salt marshes are not yet available. Copper is suggested as an economical and ecologically safe chemical to attack blue-green algae nitrogen fixation and copper is less toxic at higher trophic levels. Iron and aeration to reduce soluble iron also limits nitrogen fixation. (Danovich-Wisconsin)
W80-01447

DIEL VARIATION OF NITROGEN FIXATION BY A MARINE BLUE-GREEN ALGA, TRICHODESMIUM THIEBAUTII,
Tokyo Univ. (Japan). Ocean Research Inst.
T. Saino, and A. Hattori.
Deep-Sea Research, Vol 25, No 12, p 1259-1263, December 1978. 1 Fig, 1 Tab, 23 Ref.

Descriptors: *Cyanophyta, *Marine algae, *Nitrogen fixation, *Diurnal, Algae, Cycling nutrients, Biorhythms, Phytoplankton, Nutrient requirements, Pacific Ocean, Plant physiology, Metabolism, Bioassay, Ammonium compounds, Shikoku Island, Japan.

Study of diel variations in the nitrogen-fixing capacity of a natural population of Trichodesmium thiebautii, about 100 miles south of Shikoku Island, Japan reveals that this blue-green alga plays a central role in the nitrogen budget of low latitude seas. T. thiebautii colonies were collected from the surface at 2-3 h intervals March 8, 1977, and their acetylene reduction and ammoninum uptake were assayed immediately. Nitrogen fixation (acetylene reduction) increased after sunrise, attained maximum by noon, and declined in the afternoon. The midday activity, 60 mmole ethylene micro g chl-a h, was about 200 times the night value. This activity is the highest ever reported for marine blue-green algae and is similar to values obtained with cultured heterocystous blue-green algae. C:N ratios ranged 5.8-6.0 at daytime to 5.5-5.6 at night. Ammonium uptake hardly showed diel variation. (Danovich-Wisconsin)
W80-01448

PHOSPHATASE ACTIVITY IN EUTROPHIC TOKYO BAY,
Tokyo Univ. (Japan). Ocean Research Inst.
N. Taga, and H. Kobori.
Marine Biology, Vol 49, No 3, p 223-229, 1978. 7 Fig, 1 Tab, 23 Ref.

Descriptors: *Tokyo Bay, Japan, *Distribution, *Phosphates, *Enzymes, *Bacteria, Phosphorus, Indicators, Eutrophication, Distribution patterns, Chlorophyll, Bays, Ecological distribution, Proteins, Biochemistry, Analytical techniques, Spectrophotometry, Fluorometry, Marine bacteria.

Alkaline phosphatase activity in Tokyo Bay, Japan, July 1971 to August 1973, significantly correlates with other biological parameters such as chlorophyll and total phosphorus (TP) content, suggesting the enzyme is a good indicator of eutrophication. The enzyme shows a satisfied pattern in August and a vertically mixed pattern in December, reflecting changes in physical seawater conditions such as water temperature and salinity. Phosphatase activity in August (200 ng-at/l/h) is five times higher than in December (40 ng-at/l/h). Phosphatase activity decreases in deeper waters and also closer to the bay's mouth. Viable phosphate-producing bacteria number 100,000/ml in inner bay areas, 1000-fold higher than in the bay's mouth. Mean chlorophyll-a content in inner bay areas is 498 micro g/l, 300-fold higher than in the bay's mouth. Phosphatase activity distribution in eutrophic seawater correlates with viable bacteria counts, chlorophyll-a content, inorganic and TP concentrations, seston amounts, particulate deoxyribonucleic acids (DNA) and protein. The enzyme reflects bacterial population which in turn closely relates to TP and trophic levels. Microorganism phosphates production is not repressed at inorganic phosphorus levels (six micro g-at P/l) in the bay because bay levels are low, P turnover rate is rapid and 25% of the bacteria are constitutive phosphatase producers. (Danovich-Wisconsin)
W80-01451

THE KINETICS OF PHOSPHATE REMOVAL IN SMALL ALKALINE LAKES BY NATURAL AND ARTIFICIAL PROCESSES,
Northwestern Univ., Evanston, IL.
For primary bibliographic entry see Field 5G.
W80-01452

ASSIMILATION OF PARTICULATE ORGANIC CARBON BY ESTUARINE AND COASTAL COPEPODS,
City Univ. of New York.
M. B. Chervin.
Marine Biology, Vol 49, No 3, p 265-275, 1978. 7 Fig, 3 Tab, 36 Ref. NOAA 03-4-043-310, 04-5-022-

22.

Descriptors: *Copepods, *Detritus, *Phytoplankton, *Hudson River(NY), *New York Bight, Metabolism, Temperature, Animal physiology, Coasts, Estuaries, Estuarine environment, Diets, Nutrient requirements, Correlation analysis, Regression analysis, Mathematical studies, Respiration.

Copepod particulate organic carbon assimilation rates in the lower Hudson River Estuary and apex of the New York Bight April 1975 to March 1976 are associated with variation in body weight, temperature, and quantity and quality of food available. The New York Bight has low particulate organic carbon (POC) concentrations (less than 0.84 mg/l) and is mostly phytoplankton; assimilation rates correlate positively with POC concentrations. Hudson Estuary has high POC concentrations (greater than 0.73 mg/l) and is mostly from sewage; assimilation rates correlate negatively with POC concentrations. Assimilation rates are affected negatively by detritus quantities greater than 0.5 mg/l; at lower detritus concentrations, utilization rates (ratio of POC assimilated to POC available) increase to values ranging 4 to 10. Daily assimilation rates in both areas vary between 2.7% and 15% of copepod body weight with most values between 10% and 50%. Higher coastal respiratory rates are a function of greater detritus utilization. Estuarine elevtivity index shows a preference for living material and against detritus while coastal values indicate selection for detritus and against living material. Detritus forms between 26% and 44% of copepod diets in the estuary compared with 31% to 81% in the apex. Net growth efficiencies range from 9% to 76% and are inversely proportional to detritus percentage in diets, suggesting that detritus is inferior to phytoplankton as a food source. (Danovich-Wisconsin)
W80-01453

NITROGEN AND PHOSPHORUS IN LAKE ONTARIO TRIBUTARY WATERS,
Edgewood Arsenal, MD.
W. F. Cowen, K. Sirisinha, and G. F. Lee.
Water, Air and Soil Pollution, Vol 10, No 3, p 343-350, October 1978. 1 Fig, 5 Tab, 12 Ref. EPA R-800537.

Descriptors: *Rivers, *New York, *Nitrogen, *Phosphorus, *Chemical analysis, Lake Ontario, Nutrients, Nutrient budgets, Nutrient loading, Water chemistry, Testing, Testing procedures, Laboratory tests, Equations, Nitrogen compounds, Phosphorus compounds, Bioassay, Analytical techniques.

A nutrient availability study of organic nitrogen (ON) and particulate phosphorus (PP) forms in New York tributaries to Lake Ontario concludes that available nitrogen is estimated by NH3-N plus (NO3-N - NO2-N) plus 0.5 (TKN - NH3-N). Total phosphorus (TP) availability is estimated by adding soluble orthophosphorus (DRP) to 0.2 (TP-DRP), where DRP is approximately equal to TSP, so (TP-DRP) represents PP. The 0.2 and 0.5 factors governing availability of ON and PP, respectively, are guidelines and are highly variable, both spatially and temporally. Samples from Niagara, Genesee, Oswego, and Black Rivers were collected August 1972 to June 1973. Average total nitrogen (TN) availability in aerobic mineralization tests varies 62% to 78% of TN. Ammonia levels are generally negligible and nitrate levels are constant after 25 incubation days. ON availability results vary greatly (29% to 60%) in river samples. Average TP percentage estimated as available by chloroform treatment is greater than initial values in all rivers except the Genesee, which carries large suspended soil particle loads which absorb released phosphate. Dark incubations are variable. Algal bioassay results for all other rivers generally agrees with mineralizations and chloroform results, indicating 30% to 67% TP availability. Resin, base, and algal bioassay values for PP availability show an overall 0 to 34% range of PP extracted. (Danovich-Wisconsin)
W80-01454

PREDICTION OF ALGAL-AVAILABLE PHOSPHORUS IN RUNOFF SUSPENSIONS,
Wisconsin Univ.-Madison. Dept. of Soil Sciences
P. J. Huettl, R. C. Wendt, and R. B. Corey.
Journal of Environmental Quality, Vol 8, No 1, p 130-132, 1979. 2 Fig, 2 Tab, 11 Ref. Hatch No 1722.

Descriptors: *Phosphorus, *Analytical techniques, *Bioassay, *Chemical analysis, *Resins, *Agricultural runoff, Nutrients, Testing, Runoff, Testing procedures, Laboratory tests, Regression analysis, Phosphorus compounds, Ion exchange, Sediment load, Suspended load, Suspended solids, Fertilizers, Water pollution sources.

Use of hydroxy-Al resin for estimating potentially available phosphorus (P) in agricultural runoff suspensions shows promise as a routine method; almost as much P (98%) is removed by resin as is removed by algae in water systems. In both cases P removed is 20% to 40% of total inorganic P. Available P in natural systems depends upon sediment amounts delivered to a water body, suspension time in the photic zone, temperature, pH, light intensity, algal species, and population, and other essential nutrient available. Therefore, bioassay measurements only serve as relative algal-available P estimates. Equilibrations of prepared resin with 20 micro m soil fractions of five soil types were performed at 1,000:1 solution soil ratios. About 75% of the total P extracted is removed in the initial 24 h equilibrium. Extraction patterns show decreasing P removal rates by resin with time. Similarly, greater P uptake by algae is observed in the first 24 h incubation period than in the second Correlations between resin-extractable P and algal-available P are significant (r=0.98, n=5). However, available P amounts differ, particularly at low levels, depending on whether PAAP nutrients minus P and micronutrients or water is used as a medium. (Danovich-Wisconsin)
W80-01455

THE WATER HYACINTH: FROM PROLIFIC PEST TO POTENTIAL PROVIDER,
National Space Technology Labs., NSTL Station, MS.
For primary bibliographic entry see Field 4A
W80-01457

THE SEEDING OF TWO RED TIDE BLOOMS BY THE GERNINATION OF BENTHIC GONYAULAX TAMARENSIS HYPNOCYSTS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
D. M. Anderson, and F. M. M. Morel.
Estuarine and Coastal Marine Science, Vol 8, No 3, p 279-293, 1979. 5 Fig, 1 Tab, 33 Ref.

Descriptors: *Cape Cod, Massachusetts, *Red tide, *Water temperature, *Dinoflagellates, *Germination, Trace elements, Shellfish, Toxicity, Water pollution, Dormancy, Eutrophication, Salinity, Microorganism, Metabolism, Animal physiology, Estuaries, Spores, Benthos, Protozoa.

Data on nutrients, salinity, temperature and rainfall indicate that temperature induces spring germination of overwintering benthic hypnocysts among Gonyaulax tamarensis blooms, monitored on Cape Cod, Massachusetts salt ponds spring and fall 1977. This study focuses on basic mechanisms underlying erratic toxic dinoflagellate outbreaks which cause shellfish poisoning along the New England and eastern Canadian coastline. Water temperatures of the bottom 2.5 m in Perch Pond increase from four C on March 20 to 17.2C on April 22. Beginning in late March, motile G. tamarensis cells are present in Perch Pond and reach 60,000 cells/ml on April 22 before disappearing in mid-May. Reasons for bloom decline are unknown; motile populations may be transformed into new hypnocysts which settle into sediments. During the same spring period, G. tamarensis is not detected at nearby Great Pond until mid-April; samples from Vinyard Sound, nine km away, do not contain G. tamarensis during the study period. Extreme bloom localization is due to limited tidal advection of the motile population and favorable estuarine trace metal chemistry compared to adjacent coastal areas. Fall bloom is also seeded by hypnocysts germination with excystment initiated by temperature decreases from summer 20-22C levels. The temperature conditioning mechanism does not require overwintering; prolonged high temperatures will suffice. (Danovich-Wisconsin)
W80-01458

NITROGEN POOLS IN GEORGIA COASTAL WATERS,
Georgia Univ., Sapelo Island. Marine Inst.
E. B. Haines
Estuaries, Vol 2, No 1, p 34-39, March 1979. 3 Fig, 2 Tab, 24 Ref. NSF-DES 75-20842.

Descriptors: *Nitrogen, *Coastal marshes, *Tidal effects, *Nutrient transport, *Cycling nutrients, Georgia, Coasts, Tides, Sapelo Island(GA), Salt marshes, Inorganic compounds, Organic compounds, Nutrients, Nitrogen cycle, Nitrates, Nitrites, Ammonia, Nitrogen compounds.

The high concentration of dissolved organic nitrogen (DON) ranging 4.4-38.0 micro g at N/l, on the ebb tide and high PN concentrations, ranging 13.0-239.0 micro g at N/l, on the flood tide, suggests a net import of PN and an export of DON in a salt marsh near Georgia shelf waters. This paper discusses distribution of dissolved and particulate forms of nitrogen in inshore and nearshore waters of the Georgia coast, where extensive salt marsh estuaries are dominated by tidal flushing. Surface water samples were taken at 21 stations off the Georgia coast between two and 10 km offshore and at four stations within the mouths of Doboy and Sapelo Sounds in February, May, August, and November, 1975. The surface offshore waters were mixed to the extent that no discernable seasonal distribution pattern of the various nitrogen forms was apparent. Concentrations of inorganic nutrients, ammonia, nitrite and nitrate were fairly low, ranging from 0.0-2.2 micro g at N/l. The extremely low nitrogen concentrations measured in Georgia coastal waters at all times of the year indicates that the nitrogen distribution is dominated by internal cycling rather than by large nitrogen forms, ranging 0.0-0.9 micro g at N/l at high tide, were observed in the four nearshore stations. High concentrations of ammonia, up to 73.4 micro g at N/l, were measured in nearshore low tide water indicating a high ammonia content of the marsh soils. (Danovich-Wisconsin)
W80-01459

HORIZONTAL UNDEPENDABILITY IN THE PLANKTONIC ENVIRONMENT,
Scripps Institution of Oceanography, La Jolla, CA
J. L. Star, and M. M. Mullin.
Marine Science Communications, Vol 5, No 1, p 31-46, 1979. 3 Fig, 2 Tab, 20 Ref.

Descriptors: *Spectroscopy, *Temperature, *Chlorophyll, *Plankton, Pacific Coast region, Pacific Ocean, Fluorometry, Phytoplankton, Depth, Food abundance, Coasts, Foods, Ecosystems, Analytical techniques, Food chains

Cross-sectional computations show no coherence between chlorophyll and temperature measurements taken from horizontal transects at a 30-39 m depth in two areas of the Pacific Ocean, indicating an environment which is physically and nutritionally undependable. This paper explores dependability of the environment, by variables of temperature and chlorophyll, experienced by some marine planktonic herbivores in order to explain their adaptations in different regimes. Variations in temperature were used to reflect change in physical environment, and chlorophyll was used as an index of food availability. Horizontal transects were taken of the North Pacific Central Gyre and the nearshore region off southern California in July 1977. Continuous chlorophyll samples were recorded from fluormeter effluent and integrated samples along the transect. Near Central Gyre stations, there is a large, negative vertical gradient of temperature and a relatively smaller, positive chlorophyll gradient. The various spectra from both areas are similar and spectral analysis suggests a small and constant variability between wavelengths of 45 m and 600 m. Within the context of a

cross-spectral analysis, the food resource is not organized in relation to the physical environment. Even though the spatial scales of patchiness are similar on all transects, the nearshore environment is much more variable than the offshore. The highest chlorophyll concentrations in the Central Gyre are below the minimum found nearshore. (Danovich-Wisconsin)
W80-01460

FISHERIES IN LAKE RESTORATION,
Environmental Protection Agency, Washington, DC. Office of Water and Waste Management.
For primary bibliographic entry see Field 5G.
W80-01461

UPTAKE OF INORGANIC NITROGEN BY SODIUM FRAGILE SUBSP. TOMENTOSOIDES (CHLROROPHYTA),
Rhode Island Univ., Kingston. Dept. of Botany.
M. D. Nanisak, and M. M. Harlin.
Journal of Phycology, Vol 14, No 4, p 450-454, 1978. 1 Fig, 3 Tab, 21 Ref.

Descriptors: *Chlorophyta, *Nitrogen, *Kinetics, *Nutrients, *Northeast US, *Coasts, Algae, Light intensity, Temperature, Nitrates, Nitrites, Ammonium salts, Inorganic compounds, Nitrogen compounds, Ecological distribution, Cycling nutrients, Nutrient requirements, Plant physiology, Diets, Competition.

Codium fragile subsp. tomentosoides is a green coenocytic seaweed abundant in coastal areas along northeastern U.S.; its ecological success might be because it takes up several nitrogen (N) forms simultaneously, takes up N in darkness, and has relatively low K-s values for N uptake. Thalli were collected at Narragansett, Rhode Island, and laboratory tests on temperature and irradiance effects on nitrate nitrite, and ammonium uptake by Codium were examined. Under all temperature and irradiance combinations, ammonium uptake rates are greater than nitrate and nitrite. For all N forms, uptake is greater at 12-24C than at six and 30C. Maximum ammonium uptake rate (27.07 micro mol/g Dw/h) occurs at 84 micro Ein/sq m/s and 24C. Maximum nitrite uptake rate (3.3 micro mol/g Dw/h) occurs at 14 micro Ein/sq m/s and 24C. Maximum nitrate uptake rate (4.24 micro mol/g Dw/h) occurs at 140 micro Ein/sq m/s and 18C. Uptake rates, reduced in darkness, are 24%, 40%, and 51% the saturation rate for nitrate, nitrite, and ammonium, respectively. Michaelis-Menten constants vary with temperature. V-max for ammonium is 2.5-5 times greater than that for other N forms. V-max is greatest at 18 and 24C for nitrate and at 12-24C for nitrite and ammonium. K-s is much lower for ammonium than other N forms. Codium takes up different N forms simultaneously, giving it competitive advantage over other algae. (Danovich-Wisconsin)
W80-01462

PRODUCTION AND ENERGY FLOW IN THE MACROBENTHOS OF TWO SANDY BEACHES IN SOUTH WEST INDIA,
Dunstaffnage Marine Research Lab., Oban (Scotland).
A. D. Ansell, D. S. McLusky, A. Stirling, and A. Trevallion.
Proceedings of the Royal Society of Edinburgh, Vol 76, No 4, p 269-296, 1978. 4 Fig, 7 Tab, 69 Ref.

Descriptors: *Scotland, *India, *Energy budget, *Beaches, *Benthic fauna, *Secondary productivity, *Climatic zones, Population, Productivity, Production, Crustaceans, Bivalves, Regions, Tropic, Temperate, Rainfall, Water temperature, Respiration, Invertebrates, Mollusks.

Benthos production and energy flow along Shertallai and Cochin beaches, India, is compared with similar studies from Firemore Bay, Loch Ewe, Scotland; biomass turnover rates in tropical beaches are 10 times those of temperate beaches. Mean benthos biomass at Loch Ewe is 14.5 kcal/sq m compared with 2.82 kcal/sq m at Shertallai. Standing crop production of Loch Ewe benthos is estimated at 29 kcal/sq m/yr compared with 61.13 kcal/sq m/yr for Shertallai. Production:biomass ratios are two and 21.7 for Loch Ewe and Shertallai, respectively. Elimination to biomass ratios and mortality and longevity values are also used in the analysis. Indian benthos mortality values are most affected by salinity changes resulting from monsoon rainfall; seasonal temperature changes are small and food is constantly available. Polychaetes such as Glycera alba. Lumbriconeis latrelli, Onuphis eremita, and Scoloplos marsupialis decline in numbers during pre-monsoon and early monsoon periods followed by a post-monsoon increase. Benthos predation is affected by benthic invertebrate density and turnover. High tropical benthos species turnover rates reflect lack of physiological temperature compensation as compared with temperate species. Associated with higher metabolic rates at normal environmental temperatures, tropical species exhibit greater activity and mobility, faster growth rates, shorter life span, higher mortality rates, and greater production per unit biomass than temperate species. (Danovich-Wisconsin)
W80-01463

OXYGENATION OF A POLLUTED LAKE IN NORTHERN ITALY,
Milan Univ. (Italy). Inst. of Geology.
For primary bibliographic entry see Field 5G.
W80-01464

PROCEEDINGS OF THE 1979 U.S. FISH AND WILDLIFE SERVICE POLLUTION RESPONSE WORKSHOP, 8-10 MAY 1979, ST. PETERSBURG, FLORIDA.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, DC., 20402. U.S. Fish and Wildlife Service, Division of Ecological Services, Washington, D.C. September 1979. C. H. Brown, Editor, 218 p.

Descriptors: *Oil spill, *Hazardous substances, Chemical wastes, Detergents, *Fishkill, Fuels, Pollutants, *Water pollution effects, Water pollution sources, Animal populations, Aquatic environment, *Aquatic habitats, Aquatic life, Aquatic populations, Beaches, Coastal marshes, Estuarine fisheries, Fish populations, Fresh water marshes, Habitats, Lakes, Lake fisheries, Marine fisheries, Marshes, Shoreline cover, Spawning, Stream fisheries, Wildlife habitats, Endangered species.

The Proceedings are a compilation of papers presented at the Fish and Wildlife Service (FWS) 1979 Pollution Response Workshop, held 8-10 May 1979, in St. Petersburg, Florida. The primary purpose of the workshop was to provide FWS personnel with continuing training in responding to spills of oil and hazardous substances that may impact fish and wildlife resources and their habitats. Papers in the volume are divided into six subject areas: introductory material and a definition of the spill response problem; elements of Federal, State, local government and industry response to pollution discharges; biological and physical impacts of oil and hazardous substances; spill response techniques, including containment technology and wildlife rehabilitation; interfacing with the public, news media, and other agencies in crisis situations; and documentation of spills and environmental damage for purposes of litigation and the development of new prevention strategies.
W80-01540

ALGAL ASSAY AND CHEMICAL ANALYSIS: A COMPARATIVE STUDY OF WATER QUALITY ASSESSMENT TECHNIQUES IN A POLLUTED RIVER,
Illinois State Univ., Normal. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-01541

5D. Waste Treatment Processes

CONTROL OF FOAMING IN PULP AND PAPER MILL WHITE WATER,
Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
G. R. Lightsey, and W. B. Hall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112741, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Mississippi State University Report, October 1979. 27p, 8 Fig, 7 Tab, 23 Ref. OWRT A-125-MISS(1), 14-34-0001-9026.

Descriptors: *Water reuse, *Pulp and paper industry, *Foaming, *Recycling, *Foaming properties(Paper machine), Defoamers.

The purpose of this study was to determine the effect of water reuse on the paper machine white water properties in a pulp and paper mill with emphasis on foaming properties. Recycling of paper machine white water at recycle rates between 65% and 95% was simulated in the laboratory using both bleached and unbleached kraft pulp. The properties of the simulated white water was compared with actual paper machine white water at similar recycle rates. The data indicated that the laboratory simulation gave white water with properties reasonable close to actual paper machine white water. Both the white water's foaming tendency and its foam stability increases rapidly as the rate of white water recycle increases. Control of foaming in white water by the addition of defoamers was found to be less effective as the white water recycling rate increased. For example, to maintain the foam volume below 30 ml/1 of white water requires 20 ppm defoamer at 85% white water recycle and 50 ppm defoamer at 95% recycle. Increased white water reuse will result in greater foaming tendency and foam stability. However, this foaming can be controlled by increasing the concentration of defoamer in the white water.
W80-01261

ECONOMIES OF SCALE IN SEWAGE PURIFICATION AND DISPOSAL,
For primary bibliographic entry see Field 6C.
W80-01305

THE ECONOMIC IMPACT ANALYSIS OF EFFLUENT STANDARDS FOR TOTAL DISSOLVED SOLIDS,
Illinois Inst. of Natural Resources, Chicago.
For primary bibliographic entry see Field 6B.
W80-01310

WASTEWATER MANAGEMENT IN RURAL COMMUNITIES: A SOCIO-ECONOMIC PERSPECTIVE,
Pennsylvania State University, University Park, Institute for Research on Land and Water Resources, Information Report 103, May 1977. 154 p, 4 Fig, 15 Tab, 245 Ref. C. E. Young and D. J. Epp, editors.

Descriptors: *Wastewater, *Wastewater treatment, *Land application, *Sludge, *Legal aspects, *Rural areas, *Municipalities, *Political aspects, *Social aspects, *Planning, *Water quality control, Economics, Wastewater injection, Trickling filters, Activated sludge, Percolation, Spray irrigation, Infiltration, Land acquisition methods, Resource recovery, Wastewater reuse, Landfills, Dewatering, Federal Water Pollution Control Act, 208 Water quality planning.

This is a collection of seven papers which address planning, management and legal issues in wastewater use and application in rural communities. Activated sludge, trickling filters and lagoons are proposed as potential wastewater land application systems which can be installed at reasonable cost. Management considerations for choosing a treatment alternative include acquisition options (e.g., the fee simple option), and legal considerations (small communities stand to protect themselves legally by renting use of treatment facilities rather than building their own). Landspreading of sludge can provide small communities with a low cost, income producing means of waste treatment and disposal, but a strong educational program on

these advantages is seen as needed in rural areas. Rural areas have difficulty accepting as viable many land application methods due to their perceptions about possible health hazards and associated heavy metals disposal. A system of transferable discharge rights is proposed as an alternative charge system mechanism for communities, and can even provide optimum levels of environmental protection. Implementation of 208 Water Quality Planning could well change the distribution of rural land rights. General findings are that land application methods have feasibility for rural communities, but such communities will have to plan financing mechanisms carefully in order to afford land application in any form. (Arnold-NC)
W80-01383

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 1, ON-SITE DISPOSAL/SEPTAGE TREATMENT AND DISPOSAL.
Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 609, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-625/4-77-011. October 1977. 91 p, 34 Fig, 30 Tab, 144 Ref.

Descriptors: *Waste water disposal, *Sewage disposal, *Septage disposal, *Waste water, *Waste treatment, *Waste disposal, *Septic tanks, *Operating costs, Water quality, Loading, Farm lagoons, Sewage effluents, Waste water irrigation, Aerobic treatment, Sludge, Ultimate disposal, Decomposition, Sewage lagoons, Solid wastes, Biological treatment, Chemical treatment.

This study proposes alternative wastewater collection systems, primarily for small, dispersed rural communities. Part I concludes that wastewater disposal in such areas can be a problem due to septic tank leakage and stream pollution from simple outfall dumping. Proposed for these areas are noncentral wastewater facilities because they can adapt existing septic tank-soil absorption systems (ST-SAS), can avoid installation of costly sewer extensions, and allow more rational community growth planning. Design constraints in choosing an appropriate noncentralized community facility include water consumption, solids and pathogen reduction; ability to carry wastewater; holding tank storage; and nitrification potential. The Wisconsin Small Scale Waste Management Project (SSWMP) provided funds for specific research in this area. Part II examines septage treatment and disposal, used by over 25% of the population of 30 states. Natural digestion of septage wastes by aerobic organisms is fairly effective in most of the systems in these areas, yet occurrence of dangerous pathogens such as salmonella is still a serious problem. Various methods of septage-sewage disposal discussed included land disposal, subsurface application, spray irrigation, and aerated lagoons. Of these methods, land disposal was found to be least costly, although local constraints concerning land use, odors or poor soils, may preclude this option. (Arnold-NC)
W80-01384

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 2, PRESSURE SEWERS/VACUUM SEWERS.
Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 610, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-625/4-77-011b, October 1977. 99 p, 39 Fig, 14 Tab, 69 Ref, 2 Append.

Descriptors: *Waste water treatment, *Waste water disposal, *Waste disposal, *Solid wastes, *Sewage disposal, *Sewage systems, *Pressure sewers, *Vacuum sewers, Capital costs, Operating costs, Septic tanks.

This study discusses and analyzes the merits of pressure sewer and vacuum sewer systems as alternatives to septic tanks and simple outfalls in sparsely populated communities. Part I differentiates the two major types of pressure sewer systems: grinder pump (GP) and septic tank effluent pump (STEP) installations. Three model studies of uses of these systems in small communities indicated that costs of operation could be kept low. Design differences among GP and STEP systems are usually due to the type and materials of the effluent holding tank. Older tanks have been made of steel, but newer fiberglass tanks have been shown to operate efficiently and relatively inexpensively. Conclusions as to the usefulness and cost savings of pressure sewer systems indicate that they are a viable alternative to septic tanks where population density is low and rough terrain and soil conditions exist, and that they require lower capital costs and shorter construction times than conventional sewer systems. Part II deals with sewer systems relying on the vacuum method for waste collection, primarily for toilet systems. The various types of vacuum systems differ in their piping configurations, with the AIRVAC system using a large valve to regulate vacuum pressure. Although vacuum systems are relatively new to the United States, their installation results in reduced costs and water consumption of toilet systems. (Arnold-NC)
W80-01385

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 3, COST/EFFECTIVENESS ANALYSIS.
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5G.
W80-01386

WATER QUALITY MANAGEMENT PLAN: EXECUTIVE SUMMARY.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
July 1979, 27 p, 6 Fig.

Descriptors: *Water quality, *North Carolina, *Management, *Wastewater discharge, *Urban stormwater, *Agriculture, *Construction, *Mining, *On-site wastewater disposal, *Solid waste disposal, *Forestry, *Water pollution, Water quality control, Biodegration, Toxic substances, Sediment, Nutrients, Organic wastes, Bacteria.

This document is a summary of the principal information contained in the several separate volumes that compose North Carolina's Water Quality Management Plan. Of the 40,000 miles of streams in N.C. 2,762 miles (7 percent) are degraded, and of the over 2 million acres of estuarine water 446,909 acres (22 percent) are closed to shellfishing. Water pollutants are grouped into the following categories: organic wastes (or oxygen demanding substances), bacteria, sediment, nutrients, and toxic substances. The severity of biological degradation varies in the three major areas of the state--mountains, Piedmont, and coastal plain. The recommendations of the Plan range from educational efforts and voluntary compliance to more effective use or strengthening of existing regulatory programs. The Plan concentrates on actions state agencies can and should take. The recommendations are directed at protecting water from future activities, therefore, there are several situatons in which water quality degradation is not expected to improve as a result of the Plan. Two situations where this is true are some areas of shellfishing waters destroyed from septic tank leachate and the localized degradation of groundwater from poorly located landfills. The elements of the Water Quality Management Plan include the following (listed in decreasing order of overall contribution to N.C. water quality problems): (1) point source, (2) urban stormwater runoff, (3)agriculture, (4) construction, (5) mining, (6) on-site wastewater disposal, (7) solid waste disposal, and (8) forestry. (Iervolino-NC)
W80-01391

WATER QUALITY MANAGEMENT PLAN: IMPLEMENTATION SUMMARY,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
July 1979. 94 p. EPA P004198010.

Descriptors: *Water quality control, *Water quality, *Waste water dicharges, *Urban stormwater, *Agriculture, *Construction, *Mining, *On-site wastewater disposal, *Solid waste disposal, *Forestry, *North Carolina, *Management, *Implementation, National Pollutant Discharge Elimination System(NPDES).

This report, an Implementation Summary of the North Carolina Water Quality Management Plan, presents water quality issues and recommendations for each of the eight topical plans which, taken together, comprise North Crolin's Water Quality Mangement Plan: Wastewater Discharges, Urban Storwater, Agriculture, Construction, Mining, ON-site Wastewater Disposal, Solid Waste Disposal and Forestry. There are a total of 68 recommendations. The report also includes the status of wastewater discharges in the state. All of the recommendations included are for state rather than local action and are to be implemented by state agencies. The responsibility of the Federal government, particularly the Environmental Protection Agency (EPA), is to provide to the state the financial support necessary to carry out effectiely the environmental mandates imposed by Federal legislation. The discharge inventory itemizes all facilities having an NPDES (National Pollutant Discharge Elimination System) permit to discharge wastewater to N.C. streams and rivers. There are more than 2300 discharges identified in the inventory. For each discharger the following information is collected and identified: receiving stream, community, ownership category, facility type, facility name, county, NPDES number, sub-basin, discharge rating, discharge category, design flow, discharge description (major/minor), compliance information, compliance schedule and expiration data. (Iervolino-NC)
W80-01392

WATER QUALITY AND WASTEWATER DISCHARGES: A MANAGEMENT PLAN.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
July 1979. 98 p, 23 Ref, 8 Fig, 12 Tab, 1 Map. EPA P00498010.

Descriptors: *Waste water, *Water quality,*Waste water discharges, *North Carolina, *Management, *Water polluton, *Sewage effluents, *Water management(Applied), *Toxic wastes, *Waste treatment, *Sewage disposal, *Water pollution control, Federal Water Pollution Control Act, Waste water treatment, Waste water disposal, Effluents, Sewage, Sewage treatment, Water pollution sources.

One of a series of eight water quality management plan document which comprises the N.C. Water Quality Management Plan, this document is an assessment of wastewater disposal practices and programs in the state and their effect on water quality. The major pollutants discharged to streams include those wastes that deplete the dissolved oxygen in the water as they decompose, stimulate undesirable growth of plants or algae in the water, are toxic to fish, wildlife or humans, and cause disease in man. The planning and construction of publicly-owned wastewater treatment facilities is partially funded by both the Federal and State governments. The current program for control of wastewater discharges to streams in N.C. is based primarily on the Federal Water Pollution Control Act of 1972. Allowable discharges must meet certain requirements which are enforced through a permit program, the National Pollutant Discharge Elimination System (NPDES) managed by the U.S. Environmental Protection Agency (EPA). The NPDES permits are based principally on effluent guidelines which, prior to 1976, for the most part did not contain limits on any toxic or potentially toxic substances. Since 1976 EPA has agreed to establish effluent limitations and guidelines for certain agreed-upon toxic pollutant categories. The state has also adopted various approaches to advanced wastewater treatment in order to achieve the quality standards in special situations. Approximately half of the discharges in

N.C. need to treat their water using these advanced wastewater treatments, which are more stringent than normal treatments. North Carolina has adopted anti-degradation provisions which require that high quality waters be protected. (Iervolino-NC)
W80-01394

WATER QUALITY AND ON-SITE WASTEWATER DISPOSAL: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
July 1979, 56 p, 23 Ref, 5 Fig, 2 Tab. EPA P004198010.

Descriptors: *Wastewater disposal, *Water quality, *Septic tanks, *Sewage treatment, *Waste disposal, *North Carolina, *Managment, *On-site disposal, Wastewater treatment, Waste treatment, Water quality control, Treatment, Impacts.

This report, part of North Carolina's Water Quality Management Plan, evaluates the statewide significance of on-site waste disposal practices and problems with regard to their impact on water quality in North Carolina. Research was done on the extent of septic tank use in the state, impacts of septic tank systems on water quality practices which can prevent adverse impacts, and programs which affect on-site disposal methods. In 1970 42% of all housing units in the state were on septic tank soil absorption systems. Successful operations of a septic system depends upon: suitability of the soil to accept wastewater, level drainfield, eatablishment of a proper interface between the absorption trench and surrounding soils, timely pumping of septic tank solids and scum, minimal hydraulic and solids loading, and proper surface and subsurface drainage. Localize problems from septic tank systems can be traced to insufficient depth to water table, hydraulic overloading, malfunctions in small discharging systems, straight piping, infrequent septic tank pumping, improper septage disposal and high density housing development. Four North Carolina statutes govern the installation of on-site wastewater disposal systems in the state. The State's Coastal Area Management (GS 113A-100 to 113A-128) and shellfish sanitation (GS 130-169) regulations indirectly affect the siting and operation of on-site disposal systems in the coastal areas. Management practices and aternative actions are set forth for onsite waste disposal. The plan recommends a number of actions in the areas of education, research and administrative changes in order to reverse the trends of poor on-site wastewater disposal practices. (Iervolino-NC)
W80-01395

PACKAGE PLANTS: ONE SOLUTION TO SMALL COMMUNITY WATER SUPPLY NEEDS,
Culp/Wesner/Culp, El Dorado Hills, CA.
S. P. Hansen.
Journal of the American Water Works Association, Vol 71, No 6, p 315-323, June 1979. 12 Fig, 3 Tab, 11 Ref.

Descriptors: *Water treatment, *Waste water treatment, *Water quality, *Alternative costs, *Cost comparisons, *Package plants, *Plant design, Water supply, Water demand, Custom plants, Filtration, Water quality standards, Costs.

Package water treatment plants (compact, factory built units which incorporate coagulation flocculation, sedimentation, and filtration) offer an economical means for small communities to treat water supplies to conform to upgraded (Federal/state) water quality standards. Normally such a package plant with a 1.5 million gallons/day (mgd) could serve a community of 10,000 persons. A model package plant which could meet these needs is presented; it employs a combination of tube settlers and mixed media filters to encompass a small enough unit that is factory assembled, yet meets small city flow requirements. Criteria for choosing a particular type of package plant for a given location include its ability to meet the area's water quality standards and required water quantity flow rate, meeting certain treatment conditions such as low raw water temperature or flashy turbidity, and as complete knowledge of the treatment characteristics of the raw water as possible. 'Operator-proof' design to avoid human-caused damage must be considered in package plant selection, and package plants will probably be less costly than custom built plants primarily for flow capacity rates below 2 mgd/day. Each individual community situation should be analyzed, to determine if in fact a package plant will answer its needs. (Arnold-NC)
W80-01404

WASTEWATER ENERGY RECYCLING METHOD,
L. G. Erickson, and H. E. Worne.
U.S. Patent No 4,159,944, 7 p, 3 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 984, No 1, p 138, July 3, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water reuse, *Irrigation water, Microbial degradation, Fertilizers, Disinfection, Separation techniques, Product recovery.

An auxiliary process and method for use in wastewater treatment plants modifies conventional primary and secondary treatment to condition the effluent for use as agricultural irrigation water containing liquified fertilizer and soil amendment materials. Primary sludge and skimmed materials are comminuted and added to the volume of organic materials available for secondary treatment. A bacterial inoculum is added to accelerate the microbial reduction of biodegradable materials into a biomass of cells. The seperated predominately cellular secondary sludge is processed to rupture the cellular structure thus releasing the protoplasm to colloidal suspension. Combined with the main-flow of secondary clarified effluent, the resultant micro-particulate effluent is thereby conditioned for effective chelation treatment to remove heavy metal ions and for effective disinfection with reduced requirements for toxic reactants. The product is discharged as agricultural irrigation water containing, in solution, agricultural fertilizers as nitrogen, minerals, carbonaceous compounds and oxygen, plus ligno-cellulose soilbuilding materials. The heavy metals may be separated and recycled as a by-product. (Sinha-OEIS)
W80-01475

METHOD FOR DENITRIFICATION OF TREATED SEWAGE,
Dravco Corp., Pittsburgh, PA. (Assignee).
E. S. Savage.
U.S. Patent No 4,159,945, 5 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 1, p 138, July 3, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Denitrification, *Filtration, Nitrogen compounds, Microbial degradation, Activated sludge, Separation techniques, Water purification, Backwashing.

A method for denitrification of aqueous nitrate-containing solutions provides for denitrification of the effluent from an activated sludge sewage treatment process. Effluent from the settling zone of an activated sludge sewage treatment process containing nitrogen compounds such as nitrates and nitrites, is passed through a deep bed filter, the filter media of which has been innoculated with bacteria that converts the nitrogen compounds to nitrogen gas. The filter, in addition to removing the nitrogen compounds, also removes suspended solids from the settling zone effluent, so that the final effluent from the filter is concurrently clarified and denitrified. By controlling the backwash of the filter, bacteria is retained thereon so as to enable continuous use of the filter. (Sinha-OEIS)
W80-01476

DEWATERING SYSTEM,
L. L. Brooks, and D. A. McMillon.
U.S. Patent No 4,159,947, 9 p, 3 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 984, No 1, p 138-139, July 3, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Sludge treatment, Separation techniques, Dewatering, Filtration, Slurries, Flocculation, Equipment, Endless belts.

The invention comprises a dewatering system for removing water from flowable aqueous material, such as a slurry or sludge wherein a flocculation agent is added to the slurry if necessary. The mixture is deposited as a slurry on an endless porous filter belt movable along its length through an upper run over vacuum chambers and then into sandwiched relationship with respect to a second endless porous filter belt. The belts and their intermediate layer of the slurry are passed about an arc of a dewatering drum, and then in a sinuous path about rollers in a return run. Tension is applied to high tension belts so that additional squeezing forces are applied to the layer of the slurry. (Sinha-OEIS)
W80-01478

METHOD AND APPARATUS FOR REMOVAL OF POLLUTANTS FROM WASTE WATER,
A. J. Kovacs.
U.S. Patent No 4,160,723, 8 p, 6 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 413, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, Separation techniques, Activated sludge, Aeration, Equipment.

An apparatus is provided for removing pollutants from waste water. An activated sludge system is disclosed comprising generally a two tank system in which uniquely designed and positioned air diffusion and liquor transfer systems are utilized in combination with improved tank designs to effectively carry waste water through aeration and clarification stages to provide a fluid of a purification level not heretofore attainable from small activated sludge systems. (Sinha-OEIS)
W80-01480

WASTE WATER TREATMENT,
Ontario Research Foundation, Sheridan Park. (Assignee).
R. V. Laughton.
U.S. Patent No 4,160,724, 13 p, 3 Fig, 10 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 413-414, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Biological treatment, Industrial wastes, Domestic wastes, Denitrification, Microbial degradation, Separation techniques, Equipment.

Removal of nitrogeneous and carbonaceous contaminants from waste water is carried out in a single sludge two-tank system by a symbiotic two-step process whereby the second tank mainly oxidizes ammonia to nitrate and the first tank mainly reduces nitrate to nitrogen gas. The biological sludge is the same in both tanks but different reactions occur as the mixed microbial population moves through various environmental conditions in the tanks. Most of the carbonaceous material is removed in the first tank by a combination of biological uptake with cell growth and use of the carbon as a final electron acceptor in respiratory denitrification. (Sinha-OEIS)
W80-01481

WASTE WATER PURIFICATION PROCESSES,
Centre de Recherches Metallurgiques, Brussels (Belgium). (Assignee); and Siderurgiemaritime Maritime Staalnijverheid, Ghent (Belgium). (Assignee).
C. Josis, and A. Hans.
U.S. Patent No 4,160,725, 6 p, 2 Fig, 6 Ref; Official Gasette of the United States Patent Office, Vol 984, No 2, p 414-415, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water purification, Separation techniques, Ammonia, Phenols, Flow, Chemical reactions, Coke oven wastes, Stripping columns.

Waste water from coke ovens is purified by passing the waste water and a stripping fluid through a stripping column in counterflow. Non-volatile ammonium compounds are removed in one region of the column, phenolic compounds are removed in another region, and volatile ammonium compounds are removed in yet another region. The region in which phenolic compounds are removed is disposed at such a location that no ammoniacal vapor can traverse it. An acid and a strong base are fed laterally into the column at two different levels. (Sinha-OEIS)
W80-01482

METHOD FOR SEPARATING OILS FROM WATER,
Chevron Research Co., San Francisco, CA. (Assignee).
R. S. Wilcox.
U.S. Patent No 4,160,729, 3 p, 8 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 416, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Oily water, Oil pollution, Separation techniques, Adsorption, Deoiled petroleum asphalt bottoms.

The invention concerns a method for improving oil-contaminated water which comprises: contacting the water with a porous asphalt; and separating the resulting oil-containing bottoms from the water. The term 'asphaltic bottoms' is meant the pitch-like residue normally obtained in the processing of heavy petroleum crude oils. These materials in their deoiled form are porous and capable of acting as a sponge for oleaginous materials. The contacting of the oil-polluted water may be by any suitable means, including passing the water through a bed of particulate (pulverized, shaped, prilled, comminuted, spherized, and the like) deoiled asphaltic bottoms. The absorbed oil may be separated and recovered from the resulting oil-impregnated asphaltic bottoms by any suitable means, including solvent extraction, heating and vaporization, and the like ordinary hydrocarbon separation methods. (Sinha-OEIS)
W80-01484

PROCESS FOR MERCURY REMOVAL,
Domtar Inc., Montreal (Quebec). (Assignee).
X. T. Nguyen.
U.S. Patent No 4,160,730, 6 p, 1 Fig, 3 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 416, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, *Mercury, *Separation techniques, Chemical reactions, Entrainment, Product recovery, Hypochlorite.

A process for the removal of mercury from aqueous media containing mercury and undissolved solids comprises, adding hypochlorite to the aqueous medium, reducing the ionic mercury to elemental mercury, aerating the aqueous medium with a gas to entrain the mercury and separating the mercury from the entraining gas. (Sinha-OEIS)
W80-01485

CATCH BASIN PROCESSING APPARATUS,
LRS Research Ltd., Broomall, PA. (Assignee).
L. P. Taylor, and A. Petroski.
U.S. Patent No 4,160,734, 12 p, 2 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 417, July 10, 1979.

Descriptors: *Patents, *Waste treatment, *Sludge treatment, *Lagoons, Sewage lagoons, Cleaning, Equipment, Waste dilution, Catch basins.

A mobile system for cleaning and processing catch bains and/or lagoon waste products is described wherein the degree of waste product dilution is carefully controlled prior to transmission to the mobile dewatering truck. The system is capable of producing a substantially dry land fill end product and water suitable for recirculation or environmentally acceptable discharge to a process head or sanitary sewer. (Sinha-OEIS)
W80-01486

ROTATING TRICKLING FILTER,
Autotrol Corp., Milwaukee, WI. (Assignee).
D. G. Prosser.
U.S. Patent No 4,160,736, 10 p, 7 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 418, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Filtration, Trickling filters, Equipment, Oxygen.

A rotating trickling filter is formed from an elongated, hollow, circular cylindrical shell in which fixed film contractor media is mounted. Wastewater is introduced through an inlet at one end of the shell and exits through an outlet at the opposite end. The volume of wastewater within the shell is maintained as a small fraction of the total volume within the shell and collects as a shallow pool of wastewater at the bottom of the shell. Longitudinal channels sweep through the pool of wastewater as the shell is rotated to raise wastewater and discharge it over the media, which also rotates with the shell. In another embodiment, the shell is mounted within a holding tank of wastewater and is driven by the release of gas under pressure from a conduit beneath the shell, with the gas being trapped in cups arranged about the perimeter of the shell. (Sinha-OEIS)
W80-01487

PROCESS FOR TREATING WASTE WATER CONTAINING RADIOACTIVE SUBSTANCES,
Caicel Lts., Osaka. (Assignee); and Mitsui Shipbuilding and Engineering Co., Ltd., Tokyo (Japan). (Assignee).
K. Kokima.
U.S. Patent No 4,161,447, 6 p, 3 Fig, 2 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 666, July 17, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Radioactive wastes, Reverse osmosis, Surfactants, Separation techniques, Membranes.

The invention provides a process for treating waste waters containing one or more radioactive substances with a reverse osmotic membrane device in the presence of at least one organic surfactant selected from the group consisting of anionic surfactants, cationic surfactants and nonionic surfactants, in an amount in the range of from 0.1 to 1.0 weight percent effective to remove more than 99 weight percent of the radioactive substances. (Sinha-OEIS)
W80-01497

CLEAN WATER ACT, RSOURCE CONSERVATION AND RECOVERY ACT AND CONTROLS ON WETLANDS AND THE COASTAL ZONE,
For primary bibliographic entry see Field 6E.
W80-01557

ELECTRICAL POWER COMMITTEE (ANNUAL REPORT): PART II B. CLEAN WATER ACT (CWA) DEVELOPMENTS,
American Bar Association, Washington, DC. Natural Resources Law Section.
For primary bibliographic entry see Field 6E.
W80-01558

5E. Ultimate Disposal Of Wastes

WASTEWATER MANAGEMENT IN RURAL COMMUNITIES: A SOCIO-ECONOMIC PERSPECTIVE,
For primary bibliographic entry see Field 5D.
W80-01383

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 1, ON-SITE DISPOSAL/SEPTAGE TREATMENT AND DISPOSAL.
Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.
For primary bibliographic entry see Field 5D
W80-01384

OCEAN OUTFALL WASTEWATER DISPOSAL FEASIBILITY AND PLANNING.
North Carolina State Univ. at Raleigh, NC; and East Carolina Univ., Greenville, NC.; and North Carolina at Chapel Hill.
Final Report prepared for Coastal Plains Regional Commission and North Carolina Department of Administration, April 30, 1979. 430 p, 72 Fig, 46 Tab, 971 Ref, 12 Append.

Descriptors: *Waste water disposal, *Waste disposal, *Effluents, *Oceans, *Estuaries, *Feasibility studies, *Sewage treatment, *Sewage facilities, *Outfalls, *Planning, North Carolina, Water pollution control, Conduits, Benthic organisms, Water quality, Marine organisms, Sewage dispersion, Multiport line diffuser system, Social aspects, Health aspects, Economic aspects, Water pollution sources.

The main objectives were (1) to develop models to predict nearshore mixing and dispersion of outfall deposits; (2) to provide a general assessment of the biological, public health, economic and social impacts of coastal waste treatment plants with offshore outfalls; and (3) to develop computational tools and assessment methodologies that could be employed in site-specific evaluations for treatment plant location. Methodologies and research activities used are described in detail. Population data for North Carolina coastal counties were reviewed in order to identify possible ocean outfall locations. Effluent volume for these areas is expected to vary from about 1 to 14 million gallons per day (mgd) by the year 2000. The current practice for effluent discharge, mixing and dispersion would require the use of a multiport line diffuser outfall system for ocean outfall. Benthic communities beyond the immediate vicinity of the outfall pipe and diffuser would not be measurably altered, but heavy metals and other toxic substances may accumulate in the sediments in the immediate vicinity of the diffuser. There would be no adverse public health or socio-economic effects. Major findings indicate that construction and operation of a well-designed and operated sewage treatment plant utilizing ocean outfall and secondary treatment should not adversely affect the water column on fishery resources; effluent discharge should have no adverse affect on recreational swimming and areas now closed to shell fishing could be reopened as a result of reduced pathogen loadings; and that centralized sewer systems will increase land values and stimulate growth. (Arnold-NC)
W80-01402

5F. Water Treatment and Quality Alteration

REMOVAL OF NATURALLY OCCURRING MANGANESE FROM ALABAMA WATERS BY RAPID SAND FILTRATION USING CALCIUM AS AFILTER AID,
Auburn Univ., Al. Dept. of Civil Engineering.
S. R. Jenkins.
271ilable from the National Technical Information Service, Springfield, VA 22161 as PB80-111909, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Auburn University, Bulletin 40, October 1979, 48 p, 14 Fig, 2 Tab. OWRT A-064-ALA (3), 14-34-0001-9001.

Descriptors: *Water treatment, *Manganese, *Filtration, *Calcium, *Rapid sand filters, Lime, Alabama;.

Natural waters that have high concentrations of manganese and low concentrations of calcium are found throughout Alabama. Impounded lakes that are used as sources of public water supply are generally in the east central or northeast section of Alabama. This region includes the Limestone Valleys and Uplands, the Appalachian Plateau, and the Piedmont Plateau. Supplemental doses of calcium were shown to enhance the removal of oxi-

dized manganese by rapid sand filters. The effectiveness of 2.54 cm ID 10.2 cm deep model filters to remove the MnO2 using Ca2+ as a filter aid was shown to increase as the pH was raised. Lime was shown to act as a single chemical to both raise the pH and enhance removal by interacting with the oxide surfaces. While addition of alum to a solution of oxidized manganese improves removal by the model filters, small doses of calcium can substantially reduce the alum dosage required for maximum removal. The chemical costs can be significantly reduced by conscientious treatment of manganese-bearing water with lime.
W80-01205

TREATMENT OF AQUEOUS SYSTEMS,
CIBA GEIGY Ltd., London (England). (Assignee).
M. J. Smith, P. Miles, N. Richardson, and M. A. Finan.
U.S. Patent No 4,159,946, 8 p, 4 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 984, No 1, p 138, July 3, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, *Industrial water, *Scaling, Corrosion, Desalination apparatus, Heat exchangers.

A method is provided for inhibiting the precipitation of the scale forming salts of calcium, magnesium, barium and strontium from aqueous systems over a wide temperature range. It comprises adding to the aqueous system a minor proportion of a product comprising a telomeric compound. Salts of the telomeric compounds of the formula are compounds in which some or all of the acidic hydrogens have been replaced by alkali metal ions, ammonium ions or quaternised amine radicals. These salts also have good activity in inhibiting the precipitation of insoluble salts from aqueous solution. (Sinha-OEIS)
W80-01477

METHOD AND APPARATUS UTILIZING STAGED REVERSE OSMOSIS UNITS FOR PURIFYING AND DISPENSING WATER,
Foremost-McKesson, Inc., San Francisco, CA. (Assignee).
R. M. Harris, Jr.
U.S. Patent No 4,160,727, 10 p, 5 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 415, July 10, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Reverse osmosis, Flow rate, Membrane processes, Equipment, Water softening, Coin-operated dispenser.

The invention utilizes successive reverse osmosis stages to produce highly purified water from potable water in a manner particularly suitable for use in a coin operated vending machine. The flow rates in the reverse osmosis stages are matched so that no storage tank is required between them. Operation of the purification stages is controlled by the level of purified water in a reservoir from which it is dispensed, and the level is automatically maintained within a predetermined range. A sump pan is mounted under the remainder of the machine to catch spillage, waste, and reject (brine), a sump pump is automatically actuated when the water reaches a predetermined level in the sump pan, and a valve at the feed water inlet is closed automatically in the event that the water level gets too high in either the sump pan or the reservoir. The machine will not accept coins in the event that the water in the reservoir drops to the predetermined level or fails to meet a desired standard of purity. (Sinha-OEIS)
W80-01483

WATER PURIFICATION DEVICE AND SYSTEM,
G. A. Guter.
U.S. Patent No 4,160,738, 9 p, 6 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 419, July 10, 1979.

Descriptors: *Patents, *Water purification, *Water treatment, *Water quality control, Filtration, Reversis osmosis, Equipment, Domestic water.

A water purification unit particularly adapted for household use and for operation at high pressures, includes two main co-operating parts forming a chamber, with a seal positioned between the parts, and a cap compressing the seal and holding the two parts together. The interior of the chamber can contain one or more filtering elements such as a particulate matter filter, a carbon filter or a reverse osmosis filter. To withstand high internal pressure without leakage or damage, mechanical connections are provided within the chamber to form a further positive connection between the two main parts. Tap water is fed to the unit and purified outlet product water is discharged and introduced drop by drop into an open container, affording an aerated storage reservoir or purified water ready for use. The container includes a water overflow means from the container to an outlet drain and in addition waste water from the water purification units is also discharged to the drain. (Sinha-OEIS)
W80-01488

PROCESS FOR THE DESALINATION OF SALT CONTAINING WATER,
For primary bibliographic entry see Field 3A.
W80-01495

PROCESS FOR THE TREATMENT OF GROUND WATER,
For primary bibliographic entry see Field 3A.
W80-01496

5G. Water Quality Control

EFFECT OF QUARRY BLASTING ON GROUND-WATER QUALITY IN A LIMESTONE TERRANE IN CALHOUN COUNTY, ALABAMA,
Geological Survey of Alabama, University.
J. D. Moore, and T. H. Hughes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111735, Price Codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute, Auburn University, Bulletin 38, August 1979, 72 p, 12 Fig, 5 Tab. OWRT A-063-ALA (1), 14-34-0001-8001.

Descriptors: *Turbidity, *Water quality, *Water wells, Rock excavation, Quarrels, *Oxford(AL), Blasting.

A number of rural residents near Oxford, Alabama, reported recurring problems in turbidity of water from their individual water-supply wells and, occasionally, decreases in yield. Many residents associated the problems with blasting operations in a local rock quarry. Quarry operators were concerned about claims for damage that may relate to their activities. This research assessed parameters which could possibly be used to determine if a relationship does exist between quarry blasting and deterioration of well performance and groundwater quality. No relationship was established between blasting events and the quality of water of water in wells. Most turbidity problems occured during the dry period of the year (October-December) when water levels in some wells are as much as 40 feet lower than during summer months. Turbid or muddy water in some wells results from heavy rainfall. Heavy use of ground water, particularly during extended dry periodiods, contributes significantly to the problem. Chemical analyses provided no evidence to indicate that either the degree of attainment of chemical equilibrium or the concentrations of either major constituents or trace elements in the water has been affected by blasting. (Warman-Ala)
W80-01207

ENERGY REQUIREMENTS OF PRESENT POLLUTION CONTROL TECHNOLOGY,
Monsanto Research Corp., Dayton, OH.
For primary bibliographic entry see Field 6C.
W80-01311

ASSESSMENT OF THE ECONOMIC AND SOCIAL IMPLICATION OF WATER QUALITY IMPROVEMENTS ON PUBLIC SWIMMING,
Battelle Columbus Labs., OH.
For primary bibliographic entry see Field 6B.
W80-01314

MOBILIZATION AND ACCUMULATION OF HEAVY METALS IN FRESHWATER WETLANDS,
Connecticut Univ., Storrs. Inst. of Water Resources.
W. H. Damman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116296, Price codes: A02 in paper copy, A01 in microfiche. Research Project Technical Report, 1979. 14 p, 6 Fig, 1 Tab, 4 Ref. OWRT A-073-CONN (1), 14-31-0001-6007.

Descriptors: *Heavy metals, Nutrients, *Water levels, Hydrogen sulfide, *Connecticut, *Wetlands, Peat, Sampling, Corls, Soil water movement, Red maple swamp, Spagnum bog.

The vertical distribution of Zn, Pb, Mn, Cu, Ni, K, Na, N, Fe and Al, was studied in a series of cores taken from two Connecticut wetland types: a mesotrophic red maple swamp and an oligotrophic Sphagnum bog. Parts of the red maple swamp affected by spring and seepage water contain much higher concentrations of Cu, Ni, Mn, Fe, Na and K than the rest of the swamp or the bog. Lead, Mn and Fe concentrations are highest above the anaerobic level. Of the heavy metals, only Mn and Zn are enriched by nutrient cycling in the surface horizons of the swamp. This is best expressed in the higher parts of the swamp. The annual growth of a low Sphagnum flavicomans hummock contains amounts of Zn and Cu roughly equal to the annual atmospheric input, but only 1/2 of the Pb and 1/3 of the Ni. Apparently, Ni, Cu, and Mn are leached from the surrounding uplands into the swamp but this affects only the border areas. The red maple swamp does not act as a sink for Pb and Zn. Atmospheric input appears to be the only source of heavy metals in the surface of the bog.
W80-01379

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 2, PRESSURE SEWERS/VACUUM SEWERS.
Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.
For primary bibliographic entry see Field 5D.
W80-01385

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 3, COST/EFFECTIVENESS ANALYSIS.
Environmental Protection Agency, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 611, Price codes: A03 in paper copy, A01 in microfiche. Report No EPA-625/4-77-011c, October 1977. 1 Fig, 15 Tab, 12 Ref.

Descriptors: *Waste water treatment, *Waste water disposal, *Sewage systems, *Operating costs, *Sewage disposal, *Sewage treatment, *Cost/effectiveness analysis, *Community collection systems, Soil permeability, Septic tanks, Sewers, Waste treatment, Septic tank-soil absorption system, Groundwater, Alternative systems, Pressure sewers, Vacuum sewers, Soil conditions.

The objective of this study is to present specific information on cost/effectiveness analysis of sewerage systems for small communities and residential areas. Procedures for use in determining the feasibility and desirability of four on-site systems and four types of community collection systems are presented. The septic tank-soil absorption system (ST-SAS) was found to be the best and least costly of all four on-site systems under good (permeable) soil conditions. Generally, the four on-site systems were more effective and less costly for small community use than were the collection systems. Some limitations to on-site systems included

loss of efficiency in cold climates, restrictive use in certain soils, and the need for at least 4 feet of groundwater depth. Community collection systems excelled in providing operation in a wide range of climates and centralized control, but were costly to construct and required extensive maintenance. National Pollution Discharge Elimination System (NPDES) requirements restrict use of some on-site systems, as these systems lack efficient effluent screening. If costs allow, the conventional gravity sewage collection system is the best type of community system, but it is frequently not feasible for many sparsely developed communities. Case histories for five communities are presented to show how and why relatively innovative and nonconventional wastewater collection systems have been developed and in some cases selected as the most cost-effective solution to sewerage problems in small communities. The communities presented are: Glide-Idleyld Park (OR), Bellevue (ID), Westboro (WI), Fountain Run (KY), and East Ryegate (VT). (Arnold-NC)
W80-01386

SUBMARINE WASTERWATER OUTFALL - NEAR FIELD FLOW DYNAMICS AND MIXING,
North Carolina State Univ. at Raleigh. Dept. of Mechanical and Aerospace Engineering
For primary bibliographic entry see Field 6A.
W80-01387

WATER QUALITY AND AGRICULTURE: A MANAGEMENT PLAN,
North Carolina Soil and Water Conservation Commission, Raleigh. Div. of Land Resources.
1979. 106 p, 27 Ref, 12 Tab, 25 Fig.

Descriptors: *Water quality, *Agriculture, *North Carolina, *Sediments, *Management, *Water quality control, *Water pollution sources, *Water pollution control, *Nonpoint source pollution, Sediment control, Erosion, Erosion control, Nutrients, Pesticides, Agricultural runoff, Agricultural chemicals, Water pollution, Sedimentation, Farm mangement.

This report describes the 208 Agricultural Nonpoint Source (ANPS) Pollution study conducted in North Carolina and the selected implementation approach. Agriculture is the largest industry in North Carolina. In 1978 the state ranked first in the south and tenth in the nation with farm production valued at over $3.2 billion; over $1 billion is from tobacco alone. Farms cover 42% of the state's land area; therefore, the impact of these activities on water quality is potentially high. Impacts on water quality result from rainfall runoff carrying nutrients, sediment and pesticides off the fields and into nearby streams. Certain nutrients and pesticides, if found in a high enough concentration, can cause potential health or water quality problems; however, sediment is considered to be North Carolina's greatest water pollutant, especially in the Piedmont region. Programs which assist farmers in developing and applying sound farm management systems are Agricultural Research Service, Cooperative Extension Serice, N.C. Dept. of Agriculture, the Soil and Water Conservation Commission, USDA-Soil Conservation Service (SCS), USDA-Farmers Home Administration and USDA-Agricultural Stabilization and Conservation Service. Three possible implementation approaches for pollution control efforts were evaluated: (1) no change, 2(2) regulatory controls, and (3) voluntary approach. Conclusions indicated that a voluntary approach toward pollution control involving education, technical assistance and cost-sharing appears to be workable and immediately implementable. This approach would be most acceptable to the agricultural community. This voluntary program would seek to reduce ANPS inputs to acceptable levels. (Iervolino-NC)
W80-01393

WATER QUALITY AND ON-SITE WASTEWATER DISPOSAL: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5D.
W80-01395

WATER QUALITY AND FORESTRY: A MANAGEMENT PLAN.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
July 1979, 52 p, 32 Ref, 5 Tab, 5 Fig. EPA P004198010.

Descriptors: *Water quality, *North Carolina, *Forest management, *Management, *Silviculture, *Planning, *Water pollution control, Erosion control, Forestry, Sediment control, Lumbering, Erosion, Timber, Water quality control.

Part of North Carolina's Water Quality Management Plan, this document is an assessment of forestry in the state and its impact on water quality. Forests cover about 64% of North Carolina's land and are relied upon to meet a variety of needs. Commercial forests occupy 19.5 million acres and provide the resource base for the timber industry which ranks second only to textiles in the value of manufactured output in N.C. The principal potential water pollutants that may be generated by silvicultural activities are generally identified to be: eroded sediment, organic debris, thermal effects due to decreased shade cover, and forest chemicals such as herbicides and fertilizers. The first three effects are significant in N.C. Management practices to mitigate impacts on water quality were recommended in the following activity categories forest road construction, log decks, filter strips, stream obstructions, project close-out, site preparation and chemical application. The federal programs affecting silviculture are Agricultural Conservation Program (ACP), Forestry Incentive Program (FIP), Executive Order 11752 and National Forest Management Act (NFMA). There are also a number of state programs and laws relevant to silviculture. The Water Quality Management Plan identifies the three Best Management Practices (BMPs) which are (1) maintenance of undisturbed filter strips along streambanks, (2) proper placement and construction of access roads and skid trails, and (3) least disturbance methods of site preparation. The Plan does not specifically recommend any of the regulatory options; silviculture is a minor source of pollution in N.C., but landowners and operators should use these practices. (Iervolino-NC)
W80-01396

WATER QUALITY AND SOLID WASTE DISPOSAL: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
July 1979. 55 p, 7 Tab, 4 Fig, 18 Ref. EPA P004198010.

Descriptors: *North Carolina, *Solid wastes, *Water quality, *Water quality control, *Solid waste disposal, *Landfills, *Waste disposal, *Management, *Land management, *Solid waste disposal, Resource Conservation and Recovery Act, Erosion, Leachate, Erosion control, Impacts, Hazardous wastes, Agricultural wastes, Domestic wastes, Industrial wastes, Commercial wastes.

This report, part of North Carolina's Water Quality Management Plan, is an evaluation of solid waste management practices in North Carolina and their effect on water quality. In 1967 5 milion tons of solid waste were generated in the state; in 1968 there were 479 dump sites in the state. Solic wastes have been divided into the following categories by the N.C. Dept. of Human Resources: household wastes, commercial wastes, industrial wastes, agricultural wastes, hazardous wastes and other wastes. Adverse environmental impact of solid wastes on ground and surface waters results from leachate migration and siltation from erosion of disturbed areas. These two problems can be minimized through the proper siting, design, operation and closure of landfills. Stated are accorded a major role in solid waste management by the Resource Conservation and Recovery Act of 1976 (RCRA). The Division of Health Services (DHS) in the Dept. of Human Resources (DHR) is authorized at the state level for the regulation of solid waste disposal and is responsible for the development of the state's solid waste management plan. DHS receives planning grants annually from EPA and has permitting authority over landfill siting and operation. The N.C. General Assembly empowered the Commission for Health Services to promulgate and the DHS to enforce rules concerning the management of hazardous wastes. The Plan recommends methods to avoid leachate and erosion problems and recommends that at least one hazardous waste disposal site location and design should be completed by 1980. (Iervolino-NC)
W80-01397

OCEAN OUTFALL WASTEWATER DISPOSAL FEASIBILITY AND PLANNING.
North Carolina State Univ. at Raleigh, NC; and East Carolina Univ., Greenville, NC.; and North Carolina at Chapel Hill
For primary bibliographic entry see Field 5E.
W80-01402

THE INFLUENCE OF CHEMICAL RECLAMATION ON A SMALL BROWN TROUT STREAM IN SOUTHWESTERN WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
E. L. Avery.
Technical Bulletin No 110, 1978. 35 p, 8 Fig, 24 Tab, 10 Ref.

Descriptors: *Brown trout, *Streams, *Wisconsin, *Reclamation, *Antimycin A, *Fish management, *Stream improvement, Trout, Fish, Fish populations, Sport fishing, Productivity, Invertebrates, Fish control agents, Piscidides, Speciation, Biomass, Population, Chemicals, Chemcontrol, Culverts, Fish barriers.

Seas Branch Creek, Wisconsin, was treated October 1972 with antimycin A to eradicate forage fish populations consisting primarily of suckers, stonerollers, daces, and darters; maximum trout biomass increased from 72 kg/ha before treatment to 109 kg/ha after treatment. This study quantifies effects of chemical treatment and total fish removal on a domesticated brown trout (Salmo trutta) population, sport fishery, and aquatic invertebrates in a trout stream with some native trout but with moderate domestic stocking to maintain good fishing levels. After chemical treatment and installation of a culvert-type fish barrier, only 3% of the average pretreatment biomass was present above the barrier. Antimycin initially affected benthic populations. However, after two years all original 21 species were present below the barrier, while only nine species were observed above the barrier. Sport fishing declined during the two years following treatment. Fishing trip numbers increased 20% and total fishing pressure 6%, but total harvest declined 36%. Domestic trout survival did not improve following forage fish removal. Lack of permanent instream cover cuases poor winter survival rates and low stream carrying capacity. Chemical removal of forage fish is an effective management tool only whebn used in conjunction with an effective fish barrier. Greater stream productivity such as food supplies and trout habitat imply greater expected management gains. (Danovich-Wisconsin)
W80-01450

THE KINETICS OF PHOSPHATE REMOVAL IN SMALL ALKALINE LAKES BY NATURAL AND ARTIFICIAL PROCESSES,
Northwestern Univ., Evanston, IL
D. Haumann, and T. D. Waite.
Water, Air, and Soil Pollution, Vol 10, No 3, p 291-213, October 1978. 9 Fig, 8 Tab, 33 Ref.

Descriptors: *Kinetics, *Phosphates, *Florida, *Artificial lakes, *Nutrient removal, *Lake restoration, Phosphorus, Lakes, Phytoplankton, Runoff, Fertilizers, Nutrients, Sediments, Submerged plants, Aquatic plants, Productivity, Physicochemical properties, Growth rates.

Decreasing phosphorus (P) levels in the water column by alum treatment was highly efficient

(40.8% per day) in two small artificial lakes located on a golf course in southwest Miami, Florida. Experiments September 1972-August 1974 defined rates and mechanisms which maintain low P levels, determined average nutrient uptake mechanisms and benthic macrophyte uptake capabilities, and discovered if P removal by filter-alum with sediment sealing would be sufficient to inhibit macrophyte growth. Benthic macrophytes communities use high P levels from the water column rather than from sediments. Applied P fertilizer removal rates adhere closely to two consecutive first-order reactions. Phase I, or the first few days, corresponds to high P removal rates whereas Phase II removes P at slower rates. Natural physicochemical mechanisms remove 79.7% to 97.6% P during Phase I, however, highest per-diem removal by natural processes is 11.1%. Natural removal mechanisms consist of phosphoate absorbed to dispersed calcite surface areas with slow transmutation to hydroxyapatite. Phase II P removal results primarily from hydraulic flushing and primary productivity. Filter-alum application removes P from solution at four times natural process rates through enmeshment, absorption, and isomorphic replacement of OH- by phosphate anions in a poly-metallo-hydroxy polymer. (Danovich-Wisconsin)
W80-01452

THE WATER HYACINTH: FROM PROLIFIC PEST TO POTENTIAL PROVIDER,
National Space Technology Labs., NSTL Station, MS.
For primary bibliographic entry see Field 4A.
W80-01457

FISHERIES IN LAKE RESTORATION,
Environmental Protection Agency, Washington, DC. Office of Water and Waste Management.
L. E. Keup.
Fisheries, Vol 4, No 1, p 7-9, 20, January-February 1979. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Lake fisheries, *Water pollution control, *Water quality control, *Federal government, Fisheries, Lakes, Legislation, Reclaimed water, Water resources, Water management(Applied), Limnology, Fish management, Projects, Water resources development, Planning, Contracts.

Fishery scientists need to play a role in the development and implementation of lake restoration projects, program provided for in Section 314 of the 1975 Clean Water Act and administered by the Environmental Protection Agency, in order to assure protection and enhancement of fisheries. The lake restoration program requires states to classify and identify water quality conditions in their publicly owned freshwater lakes and include procedures, processes, and methods to control pollution to eutrophic lakes and techniques to restore them. However, lake restoration is applicable to all trophic levels and all improvement aspects of the ecology of these waters. A 50% federal matching fund is available for restoration activities. Since the program began there has been little input by fishery scientists into the plans, processes, and management schemes for lake restoration projects during and after their inception. Some parts of the lake restoration program where fishery biologists could play a major role are: (1) installation of spawning beds where they do not exist or are inadequate to support a viable fishery; (2) installation of hypolimnetic aerators to maintain DO concentrations; (3) control of bottom rooting fish such as carp as an upstream watershed erosion control technique; (4) elimination of vital spawning areas by dredging a shallow area; (5) increasing spawning grounds for game fish by constructing an access to a marshy area; (6) removal of low head unused dams on tributary streams to allow upstream travel of spawning fish. (Danovich-Wisconsin)
W80-01461

OXYGENATION OF A POLLUTED LAKE IN NORTHERN ITALY,
Milan Univ. (Italy). Inst. of Geology.
G. Bianucci, and E. R. Bianucci.
Effluent and Water Treatment Journal, Vol 19, No 3, p 117-127, March 1979. 4 Fig, 6 Tab, 11 Ref.

Descriptors: *Lakes, *Italy, *Reclamation, *Aeration, *Oxygenation, *Lake Ghirla(Italy), Oxygen, Sewage, Water pollution, Water pollution control, Flow, Mixing, Movement, Water circulation, Hypolimnion, Gases, Water purification, Reaeration, Oxygen requirements, Sewage effluents, Dissolved oxygen.

After a submersed oxygenating unit introduced pure oxygen into hypolimnion layers of polluted Lake Ghirla in August 1975, dissolved oxygen (DO) in bottom water layers increased within the whole lake basin. Lake Ghirla with 0.245 sq km area, eight m mean depth, and two million cu m volume, is located in northern Italy at 442 m asl. Sewage from Valganna Town with 700 inhabitants is discharged into the river which forms Lake Ghirla; however, the lake was fairly clean until 1973 because a marsh filtered organic matter before reaching lake waters. In 1974, recreational facilities were built on the lake and the marsh's purifying capabilities were exhausted. In 1975 the lake-bed was covered with thick black putrescent mud and in 1976, swimming and aquatic sports were forbidden. When lake oxygenation operations began, there was no DO below five m. In September 1975, the oxygen curve showed two minimum values at four and nine m, with a maximum at seven m. The oxygenating device, when properly operated, does not cause layer mixing. In November 1976, electrochemical bottom sample tests show redox potential, -125 mV; pH, 6.9; color, grey; and odor, none. Oxygenation caused marked improvement since bottom sediments became partly mineralized and lost its bad smell. During summer 1977, bathing and aquatic sports were allowed. A municipal biological sewage treatment plant is being constructed and recreational facilities are also required to treat their own wastes as an ultimate solution to the lake's pollution problems. (Danovich-Wisconsin)
W80-01464

LAKES AND PHOSPHORUS INPUTS, A FOCUS ON MANAGEMENT,
New York State Coll. of Agriculture and Life Sciences, Ithaca.
D. R. Bouldin, H. R. Capener, G. L. Casler, A. E. Durfee, and R. C. Loehr.
Information Bulletin 127, (1977). 13 p, 10 Fig, 2 Tab.

Descriptors: *Water pollution sources, *Phosphorus, *Lakes, *Water policy, Impoundments, Nutrients, Management, Decision making, Sewage, Runoff, Agricultural runoff, Farm wastes, Sewage treatment, Detergents, Domestic wastes, New York, Phosphates, Social aspects.

A study of 13 central New York lakes shows that dissolved phosphorus influences productivity of freshwater lakes and impoundments, causing algal blooms, affecting fish production, and increasing water supply costs. Algal levels are determined by dissolved phosphorus, both organic and inorganic, rather than particulate phosphorus attached to soil particles. Dissolved phosphorus in these lakes comes from sewage (55%), agricultural runoff (18%), forest runoff (15%), residential runoff (6%), and atmospheric fallout (6%). Measures for controlling dissolved phosphorus inputs to lakes generally show that a ban on phosphate detergents has no cost to municipalities or agriculture (consumer costs not estimated), tertiary sewage treatment amounts to $5-12/kg P controlled, collection and treatment of unsewered populations costs $15-50/kg P controlled, and limiting barnyard runoff costs $50-150/kg P controlled. Feasibility of several policies is also discussed: (1) no action on lakes in which algae are not a problem, (2) ban on phosphate detergents, (3) tertiary sewage treatment, (4) agricultural and residential runoff control, and (5) removing all human activities from a watershed. Sociological investigations in Fall Creek watershed reveal that people are aware and concerned about water pollution; however, individual actions are not perceived as having any significant effect on the overall watershed status. (Danovich-Wisconsin)
W80-01465

TREATMENT OF AQUEOUS SYSTEMS,
CIBA GEIGY Ltd., London (England). (Assignee).
For primary bibliographic entry see Field 5F.
W80-01477

WATER PURIFICATION DEVICE AND SYSTEM,
For primary bibliographic entry see Field 5F.
W80-01488

SPILLING OIL MAY BE HAZARDOUS TO YOUR WEALTH,
For primary bibliographic entry see Field 6E.
W80-01562

OPTIONS FOR CONTROLLING NON-POINT SOURCE WATER POLLUTION: A LEGAL PERSPECTIVE,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W80-01563

THE CONTROL OF TOXIC POLLUTANTS UNDER THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972,
Iowa Univ., Iowa City.
For primary bibliographic entry see Field 6E.
W80-01567

AN ANALYSIS OF SECTION 208 OF THE FWPCA AMENDMENTS OF 1972 AND A SUGGESTED MODEL SURFACE WATER RUNOFF ORDINANCE,
For primary bibliographic entry see Field 6E.
W80-01572

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

DEVELOPMENT OF A MULTIOBJECTIVE SCREENING MODEL FOR WATER RESOURCES PLANNING IN NEBRASKA
Nebraska Univ., Lincoln. Dept. of Mathematics and Statistics.
J. P. Dauer, and J. Krueger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111719, Price Codes: A02 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska Project Completion Report, September 1979. 5p. OWRT A-048-NEB (1), 14-31-0001-8029.

Descriptors: *Optimum development plans, *Water resources development, *Nebraska, Computer models, Methodology, Management, Planning, *Screening model.

This project was concerned with the development of a multiobjective screening model for water resources planning. The approach used in this research was to analyze several groups of objectives. The solution structure of each individual group was produced via the method of constraints. The various groups of objective were analyzed with a goal programming approach. Particular attention was given to techniques for passing the information of one groups solution structure to the next group.
W80-01206

ECOLOGY, POLLUTION, AND BUSINESS: A PROPOSED PLANNING SOLUTION,
State Univ. of New York at Albany. School of Business.
H. Kahalas, and D. L. Groves.
Long Range Planning, Vol 11, No 6, p 62-66, December 1978. 12 Ref.

Descriptors: *Pollution abatement, *Industrial plants, Planning, Ecology, Water pollution, Legal

aspects, Regulation, Institutions, Administrative agencies, Political aspects, Social values, Governments, Industries, Management, Non-structural alternatives, James River (Va).

Pollution related issues, alternative methods of control, and their implications for business management are examined from the perspective of commercial establishments as social institutions. The complexity of the ecological problem is emphasized. While attempting to be socially responsive and still maintain an economically viable institution, the business manager must be able to differentiate basic ecological values and demands from those of a transitory nature. This is difficult because knowledge of the ecosystem and the interrelationship between its component parts is not adequate. Approaches to bring about pollution control include voluntary responses of businesses for prevention or removal of pollution such as viewing the problem as one more cost of doing business, pressure from the general public, legal suits by specialized pressure groups such as the Sierra Club, and government regulation, setting minimum standards and providing economic incentives. Various alternatives to deal with the environmental issue include application of technological solutions and management of man in his institutional setting. Overall problem complexity is illustrated by the case of kepone pollution of the St. James River, Virginia. Prevention planning based on cooperation between the public, business, government, and the scientific community is suggested as the best solution. (Luedtke-Wisconsin).
W80-01300

REGIONAL FACTORS IN THE FORMATION OF THE FISHERMAN'S PROTECTIVE UNION OF NEWFOUNDLAND,
Toronto Univ. (Ontario).
For primary bibliographic entry see Field 6E.
W80-01307

A FURTHER REVIEW OF POLLUTION CONTROL,
Newcastle Univ. (Australia). Dept. of Economics.
C. Tisdell.
Newcastle University, Research Report or Occasional Paper No 44, 1978. 28 p, 10 Fig, 15 Ref.

Descriptors: *Economics, *Water pollution control, *Pollution taxes(Charges), *Regulation, *Optimization, Taxes, Marginal costs, Graphical analysis, Mathematical studies, Mathematical models, Equations, Social impact, Social aspects, Economic efficiency.

A general review of economic pollution control measures and ways in which these measures can be combined with pollution standards concludes that no simple pollution control methods is socially optimal under all circumstances. Economists have to modify earlier inflated claims for efficiency in particular social means of control since pitfalls are inherent in many alternative pollution control approaches. Mathematical models are used to discuss Pigou's taxation approach, Coase's bargaining method, sale of pollution rights as suggested by Dale, and environmental standards enforcement method by Baumol. Market-type measures such as pollution rights and uniform taxation rates need to be modified for particular application; Tietenberg's contribution is particularly important for these methods. Ambient condition variability and uncertainty limits applicability of traditional economic policies for pollution control. Non-convexities in production possib ilities and consumption relationships are also discussed. (Danovich-Wisconsin).
W80-01309

SUBMARINE WASTERWATER OUTFALL - NEAR FIELD FLOW DYNAMICS AND MIXING,
North Carolina State Univ. at Raleigh. Dept. of Mechanical and Aerospace Engineering.
F. Y. Sorrell.
University of North Carolina Sea Grant College Program, North Carolina State University, Raleigh, Working Paper 78-4, October 1978. 35 p, 4 Fig, 2 Tab, 26 Ref, 2 Append. 04-8-MO1-66.

Descriptors: *Model studies, *Wasterwater disposal, *Flow dynamics, *Mixing *Baseline studies, *Effluents, *Outfall sewers, *Marine outfalls, *Discharge(Water), *Multiple port outfall diffusers, Models, Flow rate, Velocity, Discharge, Plumes, Ports, Outfalls, Entrainment velocity.

This study develops a model of the flow dynamics and the effluent/water mixing in the near-field of a multiple port diffuser at the end of an outfall pipe. Marine outfalls are the primary subjects of the model, which attempts to model flow behavior for most effluents. The model uses the gross-flux equations of mass momentum and buoyancy and is closed by the entrainment assumption. The interaction of the round jets from individual diffuser ports was modelled by a transition from round jets to a single two-dimensional plume. Results calculated by the model were compared with previously reported experimental data. Translating the plumes at the entrainment velocity yeilded good agreement. The dilation as computed by the model was compared with experimentally measured values over as wide a range of discharge conditions as data permitted; however, there were not a great deal of data with which to compare the model This model does give reasonable agreement with the expriments over a wide range of discharge conditions and over the complete range of flow patterns. Dilution was slightly underestimated in most cases. The model should be a useful tool for design engineer in determining minimum mixing that will occur in discharge from marine outfalls in the southeastern coastal waters. (Arnold-NC)
W80-01387

COST OF CONTROLS FOR 'SMALL HYDROELECTRIC PLANTS' OR RIVER SYSTEMS,
Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering
P. A. Frick, and G. C. Alexander.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE-ET-283101, Price codes: A07 in paper copy, A01 in microfiche. Final Report to U.S. Department of Energy. Report No DOE/ET/28310-1, February 1979. 124 p, 29 Fig, 11 Tab, 4 Append, 2 Ref. E6-77-S-07-1690.

Descriptors: *Hydroelectric power *Projects, *Hydroelectric plants, *Dams, *Costs, *Engineering structures, *Hydraulic turbines, *Flow control, Impoundments, Water resources, Electric generators, Electric power, Water utilization, Operating efficiency, Reservoirs, Turbines, Dam design, Multiple purpose projects, Structures

This study analyzes the problems and costs of water power control by different types of single unit and multiple unit small hydroelectric power plants. Two plant models presented are a relatively large dam flow model with water flow through a large sluice and design discharge of about 12,000 cubic feet per second (cfs) and a small variation dam model, with design discharge of about 230 cfs. A trapezoidal shaped model dam is derived from these and proposed as an efficient example of small project hydropower generation at a cost savings. The authors conclude that there are no significant cost advantages of using a continuous (base load) means of operation of the plant over intermittent (peak load) operation. It is asserted that maximum efficiency is more readily attained by adjusting the dam's turbine blade angle than by adjusting the wicket gates alone. Finally, a comparison of various motor and telemetry modules to control small hydroplant operation reveals that units with controllable turbine runner blades are necessary for operation; and that highly sophisticated, or 'intelligent' dam operation controlling modules are not yet feasible from a cost point of view, but that future research should provide such a unit usable in small hydroelectric installations. (Arnold-NC)
W80-01388

PROCEEDINGS: STORMWATER MANAGEMENT MODEL (SWMM) USERS GROUP MEETING, NOVEMBER 13-14, 1978.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 742, Price codes: A11 in paper copy, A01 in microfiche. Environmental Protection Agency, Washington, DC., Miscellaneous Report Series. Report No EPA-60/9-79-003, November 1978. 238 p. EPA R-802411, R-805664.

Descriptors: *Mathematical models, *Urban hydrologic models, *Storm water, *Storm runoff, *Computer models, *Stormwater Management Model(SWMM), *Water management(Applied), Combined sewers, Runoff, Hydrology, Urban hydrology, Combined sewer overflows, Water pollution control, Detention basins, Flood control.

This report includes ten papers on various model-related topics presented at the semi-annual joint U.S.-Canadian Stormwater Management Model (SWMM) Users Group Meeting, held in November 1978 in Annapolis, Marylnd. One paper describes the revised SWMM Storage/Treatment model which is much more flexible than earlier versions in terms of the control units available, the pollutant routing and cost estimating. Also included in this report is a description of stormwater modelling applications in Ontario and case studies of stormwater management systems using SWMM in Cincinnati, Ohio and other locations in Ohio. Several articles describe the background, framework and applications of different stormwater modelling techniques and computer package programs. One such program is RAFFI which is newly devised and can be combined with STORM. RAFFI is a simple model which provides hourly information on flows and pollutants (BOD and SS) diverted into receiving waters from various overflow points, and treatment and by-pass operations at the plant. Other topics covered in this report are papers on computer simulation of flood relief works utilizing inlet control and detention storage, and analysis of detention basin systems, presentation of a pre-and post-processing program package for the SWMM called FASTSWMM, a methodology for evaluating agricultural best management practices (BMPs), and model applications in facility planning. (Iervolino-NC)
W80-01389

OPTIMAL ALLOCATION OF WATER FOR RURAL AND URBAN USE IN DEVELOPING COUNTRIES WITH SPECIAL REFERENCE TO IRAN,
Aston Univ., Birmingham (England), Management Centre.
K. Vaidya, and V. A. Tavokoli.
I.T.C.C. (International Technical Cooperation Centre) Review, Vol VIII, No 1(29), p 1-19, January 1979, 7 Fig, 7 Tab, 6 Ref.

Descriptors: *Water demand, *Models, *Mathematical models, *Water supply, *Planning, *Water supply development, *Water allocation(Policy), Water utilization, Iran, Tehran(Iran), Water sources, Reservoirs, Storage, Aquifers, Agricultural uses, Irrigation, Water pricing, Water policy, Water allocation, Water resources development.

Rapid growth of urban populations in developing countries has put a severe strain on many of the available resources, including water. Here, the authors consider the problem for Tehran and surrounding agricultural areas for the next 10 years. A mathematical programming model is developed to explain the optimum allocation function possibilities for water supply in the Greater Tehran Area (GTA), with respect to individual, commercial, industrial, and agricultural uses. Although major new water resource projects are bing built these alone will not meet the area's consumptive water needs for more than a couple of decades. The mathematical demand model first expresses urban demand as a function of per capita use and total/area population. Between 1960 and 1973, urban consumption of water rose 500%, although population barely more than doubled. The main objective demand function expresses use and demand as related to storage and flow capabilities of existing sources/reservoirs servicing the urban area. Major function constraints include reservoir and aquifer storage capacity, amounts lost through reservoir seepage and evaporation, and the portions of the river basins with as yet uncontrolled flow. Conclusions indicate that the area's demand will increase

over 60% in the next 10 years, and thus varying optimum shift of water supply by season and developing different pricing policies for urban and rural areas are recommended. (Arnold-NC)
W80-01407

A MODEL FOR THE ANALYSIS OF SEASONAL ASPECTS OF WATER QUALITY CONTROL,
Hebrew Univ., Jersalem (Israel); and Chicago Univ., IL.
D. Yaron.
Journal of Environmental Economics and Management, Vol 6, No 2, p 140-151, June 1979, 2 Tab, 24 Ref.

Descriptors: *Water quality control, *Water quality, *Mathematical models, *Cost analysis, *Linear programming, *Water pollution, *Discharge(Water), *Pollutants, *Seasonal models, River basins, DuPage River(IL), Streamflow, Effluents, Cost functions, Biochemical oxygen demand, Low-flow augmentation, Effluent standards.

This article presents a multiseasonal mathematical model for analysis of water quality control within a river basin, using the DuPage River Basin of Northeastern Illinois. Using one year as the basic unit of time, and dividing the basin into a given number of reaches with 60 gauging stations, pollutant concentration at any one station is expressed as a function of the level of production of each discharger, the quantity of pollutant discharged, maximum amounts of pollution by a given number of waste treatment plants, and the level of pollutant removal by each plant. 'Transfer coefficients' indicate the level of reduction in water quality due to a discharge of one unit of pollution into that reach of the river, expressed as ((mg/liter)/lb); these play a central role in expression of the function. The model has implications for its usefulness in determining the level of taxation, or charge, which should be levied on polluters, as well as helping to evaluate possible savings in water pollution abatement costs using river flow control by means of reservoirs (low-flow augmentation). Other findings from model application indicate that the marginal social cost of biological oxygen demand (BOD) varies significantly from one season to the next, particularly from a high-flow to a low-flow season, and that allowing for a higher effluent standard during the high-flow season can result in a significant cost savings. (Arnold-NC)
W80-01408

A METHOD FOR ESTABLISHING A WATER QUALITY INDEX FOR DIFFERENT USES (IQE),
Environmental Protection Services, Montreal (Quebec). Bureau of Toxic Substances.
M. Provencher, and M. P. Lamontagne.
July, 1979. 234 p, 17 Charts, 15 Tab, 40 Ref, 5 Append.

Descriptors: *Water quality, *Mathematical models, *Models, *Water management(Applied), *Water quality parameters, Baseline studies, Quebec, Water resources management, Analytical techniques, Methodologies, Data processing.

This report presents the various stages in developing a water quality index (IQE), as well as its possible applications. The IQE is a mathematical method of determining the quality of a given stretch of water in terms of a given use, with a number rating of 0 to 100. Three special types of needs were taken into account--industrial, social and ecological. Three categories of water quality were used--chemical, biological and physical characteristics--and for each category of use, a set of weighted parameters is assigned. Six computer subroutines were used to input data in order to assess the characteristics of the quality evaluation function under different conditions with different combinations of parameters. Categories of water use, such as drinking, cooling, and industry, were compared to their respective percentage use of the total water supply. Data processing was found to be both rapid and simple. The Index, which can be calculated for 17 categories, has a fairly wide field of application. The method should be useful for several purposes--to prepare relative classifications of different bodies of water, to determine changes in water quality in space and time scale; it could be a useful tool in carrying out technical studies of the aquatic environment, in establishing an indicator for incorporation into directories and data banks, and in providing information on water quality. (Arnold-NC)
W80-01409

THE INTERDEPENDENCE OF WATER, ENERGY AND ECONOMIC DEVELOPMENT IN NEW ENGLAND'S FUTURE: A SYNOPSIS OF THE WORKSHOP, OCT. 27-28, 1977,
New England River Basins Commission, Boston, MA.
E. Kaplan, R. W. Hardy, and J. S. Munson.
Brookhaven National Laboratory, Informal Report 24788, August 1978. 55 p, 10 Ref, 4 Append. USDE EY-76-C-02-0016.

Descriptors: *New England, *River basins, *Comprehensive planning, *Water policy, *Planning, *Regional analysis, Northeast US, River basin commissions, River basin development, Water resources development, Economics, Energy, Nuclear energy, Attitudes, Institutional constraints.

Water resources, energy and economic development are inseparable components for policy analysis in multistate regional planning for river basins, and any analytical methodology which omits one or more of these interacting elements will produce misleading results; nevertheless, no such comprehensive methodology is presently available for application to the New England region or any other U.S. sub-national area. This regional workshop, organized as a first step in developing a systematic and coherent research strategy for analyzing technological, economic and institutional factors governing the dynamic relationships between water use, electric power generation and economic development patterns in New England, also concluded: (1) Institutional issues are central to most energy/water/economic development conflicts and must be incorporated in any comprehensive regional analysis and assessment methodology. (2) Study factors which should be included are centralization vs. decentralization; implications of scale; conservation and rapid industrialization; institutional implications; public attitudes; accountability; evaluation techniques; data bases and technological implications. Workshop papers covered: (1) public attitudes toward nuclear power; (2) regionalism and economic development; (3) institutional factors in New England power production; (4) water resources as a New England siting determinant; (5) technological considerations; (6) impact evaluation; and (7) modeling of regional economies. (Harris-Wisconsin)
W80-01466

TRANSFRONTIER POLLUTION IN INTERNATIONAL WATER BASINS,
Eidgenoessisches Amt fuer Umweltschutz, Bern (Switzerland).
For primary bibliographic entry see Field 6E.
W80-01473

6B. Evaluation Process

PLANNING FOR WATER USE IN MINNESOTA,
Minnesota Univ., St. Paul. Dept. of Agricultural and Applied Economics.
J. J. Waelti, and R. L. Gardner.
Minnesota Agricultural Economist, No 583, October 1976, Agricultural Extension Service, University of Minnesota. 8 p. OWRT-A-031-MINN (6).

Descriptors: *Water utilization, *Planning, *Minnesota, *Irrigation, Agriculture, Water supply, Water demand, Available water, Regional development, Evaluation.

Crop losses, as experienced in dry years such as 1976, draw renewed attention to problems of water management in Minnesota. In a year of heavy farm losses, attention focuses on irrigation and agricultural uses of water. Use of water for agriculture, however, is just a portion of the total water management picture. Water, as any resource in limited supply, has a number of alternative and competing uses. Society must make decisions regarding the use and management of the limited resource. There must be planning and management on a statewide basis toward rational decisions regarding use of limited water supplies. This article is concerned with some of the planning effort relating to water resources and current issues relating to water management and use in Minnesota. (Blake-Minn)
W80-01264

ECONOMIC GRATIFICATION ORIENTATION AMONG SMALL-SCALE FISHERMAN IN PANAMA AND PUERTO RICO,
Rhode Island Univ., Kingston Dept. of Anthropology.
R. B. Pollnac, and J. J. R. Poggie,.
Human Organization, Vol 37, No 4, p 355-367, 1979. 2 Fig, 3 Tab, 38 Ref.

Descriptors: *Puerto Rico, *Commerical fishing, *Social adjustment, *Social aspects, *Social needs, *Anthropological aspects, Fisheries, Economics, Economic impact, Community development, Investment, Social impact, Budgeting, Income analysis, Correlation analysis, Variability, Regression analysis, *Panama.

Fishermen in Panama and Puerto Rico indicate strong situational components influencing differential patterning of gratification determinants. Periodicity, relative security, optimism, and opportunity structure generally influence gratification orientations. Subsample differences indicate that perceived socioeconomic progress, age, fishing income, boat ownership, and having a fishermen father are situationally influenced gratification determinants. This paper determines the effects situational differences have on both economic gratification orientation correlates and interrelationships between those correlates. Data are based on interviews with 123 small-scale Panamian fishermen and 11 adult Puerto Rican males (50 of them are fishermen). Economic gratification parameters were correlated with age, occupation, income, self-evaluation of socioeconomic position, optimism-pessimism, material culture, production ownership, education, media exposure, and urbanization. Results emphasize that in order to understand multiple determinants in regional developmental progress, subregional variation with respect to the sociocultural environment must be taken into account. Age is related to economic gratification orientations only in Panamanian urban areas; older fishermen are more deferred than younger. Panamanian urban subsample correlation analysis indicates that older fishermen have been fishing longer, are more likely to own their own home and boat, and are more optimistic about their future status, all indicators of security. (Danovich-Wisconsin)
W80-01301

COST BENEFIT ANALYSIS AND THE DETERMINATION OF BEST ENVIRONMENTAL OPTIONS,
D. C. Lewis.
Warwick University, Discussion Paper No 12, August 1978. 37 p, 4 Fig, 32 Ref.

Descriptors: *Costs, *Cost-benefit analyses, *Environmental effects, *Optimization, *Benefits, Marginal costs, Economics, Decision making, Water policy, Management, Damages, Water pollution, Water pollution control, Air pollution, Pollutants, Project planning, Governments.

A major inadequacy in many economic studies of air and water pollution problems is that the benefit side of cost-benefit analyses received scant attention. Where a recreation site is planned, plausible estimates of monetary benefits can be made. However, if the proposal includes installation of pollution control devices, complex damage estimates for different pollutants makes traditional cost-benefit techniques impractical. A cross-media evaluation methodology, adopted by Battelle Columbus Lab-

oratories, is a realistic appraisal of various environmental benefits if substantial amendments are employed. The following changes are proposed: allow experts to evaluate dispersion range, transferability, and persistence; extend the Delphi technique to allow experts to evaluate damage functions for each pollutant; modify the Delphi technique allowing brief statements explaining reasons for evaluations; use straight relative weighting of relevant pollutants rather than a two-stage weighting system; add phrase questions about different pollutants in terms of marginal rather than total emissions. Where cost-benefit analyses are impractical, environmental indices may be used. Overall, restraint must be exercised in searching for economic optimality. While economic techniques can be employed in many areas, one must always compromise with reality and compare alternatives that are institutionally feasible. (Danovich-Wisconsin)
W80-01302

GROWTH, TECHNOLOGY TRANSFER AND THE ENVIRONMENT,
Leicester Univ. (England). Dept. of Economics.
S. Ghatak.
Indian Journal of Economics, Vol 59, No 23, p 73-85, July 1978. 3 Fig, 35 Ref.

Descriptors: *Pollution abatement, *Technology, *Economic growth, *Environmental effects, Regional development, Regional economics, National income, Gross national product, Economics, Model studies, Political aspects, Area redevelopment, Governments, Technology, Research and development, Information exchange, *Underdeveloped countries, *Developed countries, *Developing countries, *International economic development.

Arguments are presented to show that the interaction between growth by means of technology transfer and the environment is important not only for developed countries (DCs) but also for less-developed countries (LDCs). The paper also develops a simultaneous equation model to estimate effects of technology transfer and of growth on pollution as well as the effects of technology transfer on growth and investment. Although environmental assimilative capacities of LDCs are generally greater than those of DCs, three factors suggest that interactions of the environment-development process should be examined for all countries: (1) If global pollution is a threat to health, then it behaves as a public 'bad' universally and is a problem as much for DCs as for LDCs. (2) Because of transfrontier externalities no single nation can set a private national optimum level of pollution. (3) LDCs need not necessarily experience the same pattern of pollution-causing technological change to support their growth as was borne by today's DCs. In the models developed here, estimations are made of the process of development by increasing output per capita; environmental degradation is treated as a cost to be borne in the process. The issue for LDCs is to find the minimum social cost path and such a path is analyzed with the model. (Harris-Wisconsin)
W80-01306

A FURTHER REVIEW OF POLLUTION CONTROL,
Newcastle Univ. (Australia). Dept. of Economics.
For primary bibliographic entry see Field 6A.
W80-01309

THE ECONOMIC IMPACT ANALYSIS OF EFFLUENT STANDARDS FOR TOTAL DISSOLVED SOLIDS,
Illinois Inst. of Natural Resources, Chicago.
L. L. Huff.
Illinois Institute of Natural Resoures, Document No 78/12, October 1978. 77 p, 3 Fig, 16 Tab, 4 Append.

Descriptors: *Effluents, *Dissolved solids, *Water quality standards, *Economic impact, *Cost-benefit analysis, Costs, Economics, Industries, Economic efficiency, Environmental effects, Discharge(Water), Water pollution, Regulation, Water quality, Illinois, Electric powerplants, Municipal water, Water pollutions sources, Benefits.

Elimination of the present total dissolved solids (TDS) effluent standard in Illinois is warrented considering the magnitude of point source versus non-point source contributions and economic impacts. The present standard is 750 mg/l; waste treatment and recycle plants are allowed 3500 mg/l. In 1977 and 1978, 1% of samples collected exceeded TDS water quality standards. Highest TDS levels are recorded in mining areas and northeastern Illinois. Average TDS leaving the state via seven rivers is 44,100,000 lb/d; 65% of this results from storm water runoff. Background from industrial groundwaters and direct industrial discharges account for only 15% TDS state load. Increased operating costs in residential, industrial, and power generation water users due to scale formation from minerals amounts to $231,000 per year if standards are eliminated. Land repeatedly irrigated with water containing high TDS reduces crop yield. Vegetation and wildlife are harmed with TDS levels over 1500 mg/l. Laxative effects and unpleasant taste occur in high TDS water. Quantitative cost assessment for agriculture, ecology, and human health effects is zero. Standard elimination benefits potable water treatment plants, electric generating stations, and industrial discharges. Total annual savings in analytical and treatment costs amount to $1 million to $8.2 million if standards are eliminated. (Danovich-Wisconsin)
W80-01310

ASSESSMENT OF THE ECONOMIC AND SOCIAL IMPLICATION OF WATER QUALITY IMPROVEMENTS ON PUBLIC SWIMMING,
Battelle Columbus Labs., OH
J. L. Moore, D. E. Perin, and B. G. Maiden.
Report to National Commission on Water Quality, February 19, 1976. 107 p, 10 Fig, 27 Tab, 4 Append. WQAC013.

Descriptors: *Water quality, *Beaches, *Recreation, *Swimming, *Federal Water Pollution Control Act, Recreation facilities, Coliforms, Sewage, Sewage bacteria, Water pollution, Public health, Water pollution control, Pollution abatement, Cities, Water quality standards, Mathematical models, Model studies, Equations, Cleveland(OH), St. Petersburg-Tampa(FL), Rockford(IL).

At best, 86% of the public and private beaches forced to close due to poor water quality may be improved by the 1972 Federal Water Pollution Control Act Amendments. A survey of 38 public health agencies in all costal and Great Lakes states and 10 island states found 13% to a total of 3,521 beaches constrained or closed because of water quality problems. For public beaches, 3-8% of national by ac reage is constrained by degraded water quality. 39% of the closings were for less than two weeks, however, 14% of the beaches are permanently closed. The majority occur in or near metropolitan areas; 72% are due to high coliform or fecal coliform counts, which indicate possible intestinal parasites or pathogens. Improper sewage disposal causes high coliform counts. Water quality improvements could increase present seasonal recreational swimming 1.2-2.7% and also produce a shift (8-28%) in outdoor swimming locations opened as a result of improved quality. Gains in recreational swimming facilities will be primarily in urban areas. A model estimating recreational gains was tested on three areas: Cleveland, Ohio; St. Petersburg, Tampa, Florida, and Rockford, Illinois. The Act may result in a minimum increase of six million annual activity days and a 7.4 million gain by 1983. (Danovich-Wisconsin)
W80-01314

ECONOMIC AND LEGAL ENFORCEMENT MECHANISMS.
For primary bibliographic entry see Field 6E.
W80-01467

TENNESSEE VALLEY AUTHORITY'S USE OF RECREATIONAL BENEFITS IN RESOURCE ALLOCATION FOR MULTIPLE-PURPOSE WATER RESOURCE PROJECTS,
Tennessee Univ., Knoxville.
W. H. Hedley.
M Sc Thesis, December 1977. 67 p, 1 Fig, 21 Tab, 30 Ref.

Descriptors: *Benefits, *Tennessee Valley Authority, *Multiple purpose projects, *Recreation, *Resource allocation, Cost-benefit analysis, Federal project policy, Multiple-purpose reservoirs, U.S. Army Corps of Engineers, U.S. Soil Conservation Service, Economic evaluation, Economic justification, Federal government.

Comparison of demand and value measurements made by the Tennessee Valley Authority and by various federal agencies in establishing recreational benefits of government-built water resource projects shows that each agency complies with federal requirements that benefits and costs of recreation opportunities be measured by and accounted for in agency justifications of the projects. However, the investigation shows that TVA, the U.S. Army Corps of Engineers and the Soil Conservation Service all used different methodologies to conform with the regulations. Recommendations derived from the investigation: (1) Standardized methods should be developed for determining the value of water-based recreation benefits. (2) Methodologies should be developed to determine the most accurate standard criteria for demand and value measurements. (3) Procedures are needed to determine which estimated recreational benefits are most accurate. For example, 5-10 yr intervals could be used to check the validity of recreational benefit projections. (4) Criteria used in determining the demand and value measurements should be verified by further field studies at the reservoirs in question. (5) Standardized criteria and procedures for analyzing data should be formulated to single out pertinent information for more accurate recreational benefit projections. (Harris-Wsiconsin)
W80-01469

THE SOCIAL AND POLITICAL MATRIX OF ENVIRONMENTAL ATTITUDES. AN ANALYSIS OF THE VOTE ON THE CALIFORNIA COASTAL ZONE REGULATION ACT,
Pennsylvania State Univ., University Park. Div. of Man-Environment Relations.
J. F. Wohlwill.
Environment and Behavior, Vol 11, No 1, p 71-85, March 1979. 2 Tab, 8 Ref.

Descriptors: *California Coastal Zone Regulation Act, *Attitudes, *Social values, *Correlation analysis, Public opinion surveys, Psychological aspects, Regulation, Zoning, Coastal zone management, Non-structural alternatives, Social aspects, Political aspects, Legislation, California, State jurisdiction, Coasts, Pacific Ocean.

Among numerous state-wide referenda included on the ballot in California for the 1972 general election in November was Proposition 20, the California Coastal Zone Regulation Act. This legislation, which became the focus of statewide pro- and anti-environmentalism controversy, provided that a strip of land adjacent to the state's Pacific shoreline would be subject to comprehensive planning and rigid controls, regardless of private property ownership. The act passed with about 55% of the vote. Intercorrelations between Proposition 20 and other votes shows: (1) Pro-environmental attitudes are positively related to political and social liberalism. (2) Environmental attitudes do not form a unitary and homogenous entity. (3) Environmental attitudes are only partially dependent on social or political values. Demographic correlates of the vote on Proposition 20 show: (1) Support of coastal zone controls is more related to educational level than to income. (2) Even for communities along the shore, there is not a clear association between home ownership and the Proposition 20 vote. (3) Voters living some distance from the coast are somewhat less likely to support the zoning act than those residing close to the shore. (4) There is no evidence that persons residing close to the shore oppose zoning controls because of any real or imagined sense of proprietary rights. Generally, results show that environmental concerns as expressed in the polling booth are based on deliberate decisions confronting the voter, while political and social attitudes are gratuitous expressions of opinion. (Harris-Wisconsin)

W80-01470

A SURVEY RESEARCH EVALUATION OF CITIZEN PARTICIPATION STRATEGIES,
Massachusetts Univ., Amherst. Water Resources Research Center.
M. O. Ertel.
Water Resources Research, Vol 15, No 4, p 757-762, August 1979. 5 Tab, 8 Ref. OWRT B-050-MASS (2), 14-31-0001-6086.

Descriptors: *New England, *River basin commissions, *Evaluation, *Public participation, Planning, Water resources, Surveys, Effects, Research, Data, Public meetings, Public reaction.

The New England River Basins Commission has utilized communication strategies designed to stimulate public involvement in the planning process of three 'level B' studies. The effectiveness of these strategies, including agency-produced printed information, use of the mass media, personal staff contact, and public meetings has been evaluated by means of questionnaires administered to members of the public who attended the final public meetings conducted in each study. The implications of the research findings for more effective functioning of citizen participation programs are discussed. (Bell-Graf--Cornell)
W80-01542

FUTURE EFFECTS ON THE MINING INDUSTRY OF 1977 CLEAN WATER ACT,
Kennecott Copper Corp., Salt Lake City, UT.
I. G. Pickering.
Mining Congress Journal, Vol 65, No 2, p 75-77, 80, February, 1979.

Descriptors: *Water pollution control, *Economic impact, *Mine wastes, *Mineral industry, Mining, Legislation, Environmental control, Federal Government, Administrative agencies, Administrative decisions, Regulations, Cost-benefit analysis.

In the proposed National Pollutant Discharge Elimination System (NPDES) revisions, the federal Environmental Protection Agency (EPA) has shown clearly its intention to propose the most stringent controls possible on every pollutant discharge from each industrial plant. This intention is demonstrated in the 1977 Clean Water Act (C.W.A.). The mining industry may expect the most stringent application of water pollution control that EPA can maintain. The industry must prepare for 'worst case' interpretation from EPA. Standards will be ever moving environmental targets as standards are set and later revised. A zero discharge concept markedly more severe than anticipated looms on the horizon. C.W.A. regulations may curtail existing mining operations and create cost roadblocks for opening new mines. To remain a viable, productive force in this country, the mining industry must make a reasonable profit and return on investment. If the government continues to require the industry to commit its assets to pollution control until it is a breakeven or failing, the industry will not continue to exist. (Ewing-Florida)
W80-01575

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

AN ECONOMIC ANALYSIS OF COST SHARING ARRANGEMENTS IN WATER AND RELATED LAND RESOURCES
Montana State Univ., Bozeman. Dept. of Agricultural Economics.
H. Holje.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112410, Price codes: A01 in paper copy, A01 in microfiche. Montana Joint Water Resources Research Center Montana State University, Research Report Number 101, October 1979. 60 p, 30 Ref.

Descriptors: Water resources, *Economics, *Cost sharing, Cost benefit analysis, Water resources development, Federal government, State governments, Systems of accounts, Opportunity costs, Cost sharing options.

This report is primarily a historical review and philosophical essay of cost sharing issues, options and policies as they pertain to the development, financing and management of our Nation's water resources. A brief review is presented of the more important legislative acts dealing with economic evaluation, cost allocation and cost sharing. This is followed by an analysis of the problems facing our various governmental units in establishing an equitable and efficient cost sharing system. It is quite clear that the present Administration has stressed the fact that all future water resources developments will come under much closer scrutiny in the future, both in terms of evaluation and cost sharing policies. This is well illustrated by the so-called 'hit list' that developed early in the present Administration. With the strong inflationary trends of the present-day and the feeling that greater support should be provided by state and local governments it is fairly evident that the days of highly subsidized developments by the Federal government are coming to an end. Without question, this means that state and local governments, as well as private beneficiaries, are going to have to develop new methods for financing water resource developments if they feel these developments are essential to their economic welfare. (Hunt-Mont)
W80-01204

COSTS AND RETURNS FOR PRODUCING CATFISH FINGERLINGS,
R. E. Allain, and W. R. Morrison.
Arkansas Agricultural Experiment Station Bulletin, No 831, p 3-24, November 1978. 2 Fig, 13 Tab, 4 Ref.

Descriptors: *Agriculture, *Costs, *Catfishes, Fish farming, Economics, Prices, Investment, Return(Monetary), Economic efficiency, Model studies, Profit, Comparative costs, Capital costs, Operating costs, Facilities, Equipment, Economies of scale.

Costs of providing a constant monthly number of catfish fingerlings for sale to maintain orderly marketing is studied. Using the best available production technique, general techniques are to estimate investment requirements, annual costs, monthly unit catfish fingerling farms. Estimated investments in land, levees, pumping plants, plumbing, broodfish, buildings and equipment total $244,265 for an 80 acre farm and $423,443 for a 160 acre farm. Estimated total annual costs for the small farm are $124,802 and $208,643 for the large farm. Economies of size result in a more favorable cost per fingerling in any given month for the large farm. Monthly gross returns are estimated by two pricing methods yielding $15,000 under constant-unit pricing and $15,000 to 20,000 under margin pricing for the small farm and $30,240 to $35,280 respectively for the large farm. Net returns for the 80 acre farm are estimated at $1,559 to $6,585 per month under constant unit price and $5,309 to $6,585 under margin pricing, while the 160 acre farm nets $9,256 to $15,706 and $14,296, to $15,706. Investment pay back periods range 2.3 to 5.1 years depending on the investment and net return used. Cash needs for the annual ongoing operation are estimated at $94,310 and $158,166 for the small and large farm respectively. (Luedtke-Wisconsin)
W80-01303

ECONOMIES OF SCALE IN SEWAGE PURIFICATION AND DISPOSAL,
M. R. J. Knapp.
The Journal of Industrial Economics, Vol 27, No 2, p 163-183, December 1978. 2 Fig, 3 Tab, 45 Ref.

Descriptors: *Sewerage, *Regression analysis, *Economies of scale, *Costs, Sewage treatment, Sewage disposal, Economics, Planning, Pricing, Statistical analysis, Model studies, Optimization, Equations, Operating costs, Biochemical oxygen demand, Flow, Suspended solids, *United Kingdom.

This empirical study of sewage purification and disposal costs of 172 British facilities March 1972-1973 reveals strong and pervasive economies of scale over broad output value ranges. Statistical cost functions with least-squares regression techniques are used. Study findings are tempered by conceptual gaps: capital costs are omitted; price and technology variable are not adequate; estimated average cost fluctuations represents short-run cost-output only; and weekly, daily, and hourly fluctuations in sewage flow are omitted. Production levels are measured by total volume of sewage treated daily to degree of purification. Average operating costs form an L-shaped curve when plotted against output, implying significant scale economies by operating sewage purification and treatment works in lower output ranges up to 10 million gallons daily, but few economies thereafter. In larger works, diffused air activated sludge and vacuum mechanical dewatering methods raise costs and land treatment of final effluent lowers average costs. The basic average cost curve is a simple hyperbolic function of daily flow. Two other variables which are significant average operating cost predictors are: proportions of biochemical oxygen demand removed during purification and the average strength of influent as measured by suspended solids content. Scale diseconomies in collection and transmission costs depend upon population density, local topography, and treatment facility location in the area. (Danovich-Wisconsin)
W80-01305

ENERGY REQUIREMENTS OF PRESENT POLLUTION CONTROL TECHNOLOGY,
Monsanto Research Corp., Dayton, OH.
R. W. Serth, and R. S. Hockett.
Report EPA-600/7-78-084, Interagency Energy/Environment R & D Program Report, May 1978. 90 p, 8 Fig, 35 Tab, 74 Ref, 2 Append. 68-02-1320.

Descriptors: *Water pollution control, *Pollution abatement, *Energy, *Cost analysis, Electric powerplants, Industrial plants, Iron, Steel, Treatment facilities, Waste water treatment, Solid wastes, Waste disposal, Environmental engineering, Regulation, Industrial wastes.

About two percent of total annual U.S. energy consumption, about 1.7 quads, are required to meet government regulations for pollution control at stationary sources in 1977. These values represent operating energy only; an additional 0.2 quad would be needed for fabrication and installation of the pollution control equipment. Projections for the mid-1980s indicate that the percentage energy requirement for stationary-source pollution control will increase only slightly to 2.5-3.0 percent of U.S. 1985 energy consumption. For 1977, the source breakdown of pollution control energy requirements are: (1) 58 percent for industry; (2) 20 percent for powerplants; (3) 16 percent for municipal wastewater treatment plants; (4) 6 percent for solid waste disposal. Of the industrial pollution control energy requirement, about 80 percent is for seven industries: paper; primary metals, chemicals, petroleum; fabricated metals; stone, clay and glass, and foods. Of these seven industries, primary metals alone accounts for more than one-third the energy total. Iron and steel production requires about 70 percent of the pollution control energy among the primary metals, and this sub-industry accounts for 25 percent of the energy requirement in the general industrial sector and about 15 percent of the requirement from among all stationary sources. Alternative pollution control methods which require less energy but which still satisfy environmental regulations and standards are also discussed. (Harris-Wisconsin)
W80-01311

ECONOMIC ANALYSIS OF TECHNOLOGY TO COMPLY WITH P.L. 92-500 GROUP A INDUSTRIES.
National Planning Association, Washington, DC.
I. Gutmanis, R. P. McKenna, and D. Paul.
Report prepared for National Commission on Water Quality, August 1975. 6 Fig, 29 Tab, 7 Ref.

Descriptors: *Costs, *Technology, *Industries, *Water quality standards, *Water quality act, Economics, Water quality, Regulation, Water pollution control, Pollution abatement, Effluents, Capi-

tal costs, Operating costs, Maintenance costs, Pulp and paper industry, Laundering, Industrial production, Economic impact, Fish farming, Construction materials, Soaps, Detergents, Paints, Steam, Roofing materials, Lumber, Concrete, Asbestos.

This final economic report focuses on 'A' industries, which are relatively minor polluters, and costs and technology available to comply with the Water Quality Act. The study covers (1) timber products, (2) fish hatcheries and farms; (3) furniture and fixtures; (4) soap and detergents; (5) paint and ink formulations and printing; (6) paving and roofing materials; (7) glass; (8) structural clay; (9) pottery and related products; (10) concrete, gypsum and plaster products; (11) asbestos products; (12) insulation fiberglass; (13) auto and other laundries; and (14) steam supply industries. The soap and detergent manufacturing sector is taken as an example. It is divided into several subcategories: soap, synthetic organic detergents, inorganic alkaline detergents, and other crude oil and natural oil combinations. In 1968, 30.6 billion gal water were used; 19.7 billion gal were discharged. The industry is not a major polluter; its discharges are non-toxic and pose no serious threat to aquatic life. Most plants are situated in well-developed, industrialized areas and 95-98% use municipal sewer systems. The approximate maximum investment (I) BPT costs for small soap plants are $2.1 million with $155,000 operating and maintenance (O&M) costs, for small liquid detergent plants $3.2 million (I) and $219,000 (O&M), and for large integrated soap and detergent plants $1.2 million (I) and $92,400 (O&M). The overall cost to the industry is relatively small compared to their income and expenses. (Danovich-Wisconsin)
W80-01312

ECONOMIC ANALYSIS OF TECHNOLOGY COSTS TO COMPLY WITH P.L. 92-500 GROUP B AND C INDUSTRIES,
National Planning Association, Washington, DC.
Report prepared for National Commission on Water Quality, November 1975. 282 p, 1 Fig, 165 Tab.

Descriptors: *Costs, *Industries, *Technology, *Water quality act, *Water quality standards, Regulation, Water pollution control, Water quality, Pollution abatement, Economics, Sugar beets, Sugarcane, Transporation, Oil industry, Food processing industries, Canneries, Commercial fishing, Construction, Rubber, Construction materials, Effluents, Capital costs, Operating costs, Maintenance costs, Economic impact.

This publication focuses on Group B and C industries or relatively major polluters, and costs and technology available for complying with the Water Quality Act. The study covers (1) petroleum and gas extraction; (2) beet sugar; (3) cane sugar; (4) canned and preserved seafood processing; (5) brewing; (6) builders paper products; (7) rubber processing; (8) ferroalloys and calcium carbide industries; and (9) transportation. Water pollution control technology for the petroleum and gas extraction industry includes reinjection, plate coalescers, and flotation cells. Whether economic impacts from pollution abatement costs will be deleterious depends largely upon oil prices. Water pollution control technology for cane sugar manufacturing includes filter cake slurry disposal, processed water and complete treatment. Total annual costs (investment and operation and maintenance) for liquid cane sugar facilities are $1.3 million for 366,000 tpy output; for large crystalline refineries, $438,451 is required, (381,000 typ output). Four basic technological options are available for the builders paper manufacturing industry; activated sludge or serated stabilization basins (ABS), followed by retention and landfill or incineration. For the industry the capital $/ton output and O&M $/ton amount to 20.12 and 1.64 for activated sludge and incineration, 14.45 and 1.42 for activated sludge and landfill, 17.35 and 1.24 for ABS, retention, and incineration, and 11.92 and 0.99 for ABS, retention, and landfill, respectively. (Danovich-Wisconsin)
W80-01313

PLANNING WATER SUPPLY: COST-RATE DIFFERENTIALS AND PLUMBING PERMITS,
Cincinnati Univ., OH. Dept. of Economics.
H. C. Goddard, R. G. Stevie, and G. D. Trygg.
Report EPA-600/5-78-008, May, 1978. 202 p, 27 Fig, 21 Tab, 4 Append. R-803596-01.

Descriptors: *Cost analysis, *Water rates, *Forecasting, *Water distribution(Applied), *Water works, *Pricing, Hamilton County(OH), Equity, Economics, Costs, Consumptive use, Water demand, Utilities, Water supply, Regional analysis, Econometrics, Ohio, Planning, *Cincinnati(OH).

Data from the Cincinnati Water Works supply area in Hamilton County, Ohio show that plumbing permit records cannot be used as earlier hypothesized to accurately predict future water use within such customers areas. Also disproven was a supposition that peak-period water users around Cincinnati are subsidized by off-peak users. The study from which these conclusions are derived is concerned with: (1) measurement of costs of water supply; (2) calculation of net revenue differences among customers by class and location; (3) water demand analysis as based on plumbing permit applications. Water supply functions are disaggregated into (1) acquisition and treatment and (2) transmission and distribution. From the breakdown, the cost of delivering water to various customers by class and specific user are calculated as a function of distance, altitude and time of year. Resultant costs are then compared with revenues from each customer class; net revenues from each are calculated and resulting va iations are displayed for further analysis through computer mapping techniques. In general, the pricing structure of the Cincinnati Water Works is equitable for city residents and suburbanites, but correspondence between rates and average delivered costs is weak; moreover, CWW incurs revenue deficits on industrial and commercial water users while obtaining a revenue surplus from residential users. (Harris-Wisconsin)
W80-01315

WASTEWATER MANAGEMENT IN RURAL COMMUNITIES: A SOCIO-ECONOMIC PERSPECTIVE,
For primary bibliographic entry see Field 5D.
W80-01383

CAN OFF-PEAK PUMPING CUT UTILITY POWER COSTS,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 6D.
W80-01405

POLLUTION CONTROL: ECONOMISTS' VIEWS,
London School of Economics and Political Science (England).
For primary bibliographic entry see Field 6E.
W80-01471

THE ASSESSMENT OF POLLUTION DAMAGE TO AQUATIC RESOURCES: ALTERNATIVES TO THE TRIAL MODEL,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-01549

6D. Water Demand

A SYSTEM FOR REGIONAL ANALYSIS OF WATER AVAILABILITY,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W80-01295

THE DEMAND FOR ANGLING AT THE DERWENT RESERVOIR, 1970 TO 1976,
Newcastle-upon-Tyne Univ. (England).
D. M. Shucksmith.
Journal of Agricultural Economics, Vol 30, No 1, p 25-37, January 1979. 4 Fig, 27 Ref.

Descriptors: *Recreation demand, *Gasoline, *Prices, *Fishing, *Willingness-to-pay, Costs, Recreation facilities, Economics, Elasticity of demand, Rural areas, Tourism, Effects, Fees, Planning, *United Kingdom, Derwent Reservoir(UK), Clawson method.

The Clawson method which links the willingness of visitors to pay travel costs and size of entrance fees, is used to: (1) estimate the demand relationship for angling at the Derwent Reservoir; (2) examine stability of the annual demand schedule 1970-76; and (3) assess effects of changes in real gasoline prices 1970-76 on the demand for fishing at the Derwent Reservoir, and on its general significance for outdoor recreation. Demand for fishing at the Derwent Reservoir should be responsive to changes in real costs of the entire recreation experience, whether in gasoline prices or in entrance fees. However, cross-sectional socioeconomic differences and annual quality variations have little effect. The underlying demand relationship is stable for all seven years. Because demand is highly price-elastic, consumption was drastically reduced as a result of increased costs. Extrapolating this to recreation in general, implies that additional increases in real gasoline prices would have serious effects both for recreation sites and for the outdoor recreation economy. Higher gasoline prices would primarily affect casual day and weekend recreation, leading to shorter trips and a heavier concentration of visitors in the countryside closet to urban areas. (Luedtke-Wisconsin)
W80-01304

PLANNING WATER SUPPLY: COST-RATE DIFFERENTIALS AND PLUMBING PERMITS,
Cincinnati Univ., OH. Dept. of Economics.
For primary bibliographic entry see Field 6C.
W80-01315

PACKAGE PLANTS: ONE SOLUTION TO SMALL COMMUNITY WATER SUPPLY NEEDS,
Culp/Wesner/Culp, El Dorado Hills, CA.
For primary bibliographic entry see Field 5D.
W80-01404

CAN OFF-PEAK PUMPING CUT UTILITY POWER COSTS,
Montgomery (James M.), Inc., Pasadena, CA.
Junn-Ling Chao.
Journal of the American Water Works Association Vol 71, No 5, p 259-263, May 1979. 10 Fig, 4 Ref.

Descriptors: *Reservoir storage, *Storage capacity, *Water storage, *Pumped storage, *Electric power, *Energy cost ratios, *Storage reservoirs, Water costs, Utility costs, Reservoirs, Water supply, Water levels, Water distribution(Applied), Flow.

The author explains and compares four case methods of typical municipal pump/storage operations in an attempt to derive a least cost method of such storage. Many water supply distribution systems that cannot rely on gravity alone rely on a combination of pumping stations and reservoirs. Comparisons are made between strategies of providing water to a community through a system which is continuously pumping new water into storage, a system which pumps only during 10 off-peak hours/day without constant demand, a 10 hour off-peak pumping system with constant demand, and a somewhat more complicated system employing a daily combination of 14 hour peak and 10 hour off-peak pumping. Overall water storage level is found to be highest with the 10 hour off-peak pumping system (pumping rate = 240 percent), and is lowest with the continuous, 24 hour pumping alternative (pumping rate = 170 percent). Conclusions indicate that achieving cost savings through more off-peak pumping must be approached cautiously and on a case-by-case basis because the characteristics of each water distribution system differ and few existing water distribution systems have the reserve pumping, transmission main, and reservior storage capacities needed to pump only at peak

hours. Further, installation of such off-peak pumping capability should be preceded by study of the effects on local power rates, overall system friction loss, and reservoir level vatiation. (Arnold-NC)
W80-01405

WATER SUPPLY CONSTRAINTS ON NIGERIA'S ECONOMIC DEVELOPMENT: THE CASE OF ANAMBRA STATE,
Nigerian Inst. of Social and Economic Research, Ibadan.
D. C. I. Okpala.
I.T.C.C. (International Technical Cooperation Centre) Review, Vol VIII, No 1(29), p 21-35, January 1979, 11 Tab, 33 Ref.

Descriptors: *Water supply, *Water demand, *Water resources development, *Water utilization, *Water requirements, *State government, *Water supply development, Regional development, Economics, Nigeria, Anambra State(Nigeria), Africa, Water projects, Consumptive use, Industrial use(Water), Agriculture, Irrigation, Water costs.

This paper evaluates the current water supply situation in the State of Anambra in Nigeria. Population varies from 60,000 to 320,000 and water supply consumption varies from 8.4 to 18.6 gallons per capita among the major regions of Anambra. Implications for this supply/population picture are that adequate supplies do not now exist in Anambra and thus must be increased for domestic uses, agriculture (irrigation needs), power generation and recreation. An increase in the amount of piped water to provide safe drinking water is essential in fighting the spread of disease in this area. Some areas have almost no water and supplies in many areas are impure. The problem of water inadequacy in Anambra State is partly due to inadequate technological expertise but the main problem is a lack of adequate funds. Good hydrological data exist and water schemes have been planned but no funds are available to execute them. The State government is unable to finance additional water supply services. Funds must be found for provision of adequate water and other infrastructure services, which are prerequisite foundations for real economic development. The funds will have to come from the Federal government in view of the almost complete federalization of the chief revenue sources. (Arnold-NC)
W80-01406

OPTIMAL ALLOCATION OF WATER FOR RURAL AND URBAN USE IN DEVELOPING COUNTRIES WITH SPECIAL REFERENCE TO IRAN,
Aston Univ., Birmingham (England), Management Centre.
For primary bibliographic entry see Field 6A.
W80-01407

WATER RESOURCES DATA OF THE SEWARD AREA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
L. L. Dearborn, G. S. Anderson, and C. Zenone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-101298, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-11, 1979. 45 p, 6 Fig, 6 Tab, 8 Ref.

Descriptors: *Available water, *Surface waters, *Groundwater resources, *Water quality, Aquifers, Water wells, Water yield, Streamflow, Flow rates, Low flow, Water supply, Flood plains, Flood frequency, Hydrologic data, Hydrographs, Water demand, Projections, Alaska, *Seward area, Log-Pearson distribution, Maritime climate.

Seward, Alaska, obtains a water supply of about 2 million gallons per day primarily from Marathon Springs and the Fort Raymond well field. The springs have supplied up to 800 gallons per minute, and the city's deep wells currently have a combined capacity of about 3,000 gallons per minute. Freshwater is abundant in the area; future public supplies could be derived from both shallow and deep ground water and from stream impoundment with diversion. High deep-aquifer transmissivity at the Fort Raymond well field indicates that additional wells could be developed there. Water quality is generally not a problem for public consumption. A flood potential exists along several streams having broad alluvial fans. (Woodard-USGS)
W80-01427

HYDROLOGIC EFFECTS OF ANNUALLY DIVERTING 131,000 ACRE-FEET OF WATER FROM DILLON RESERVOIR, CENTRAL COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
W. M. Alley, D. P. Bauer, J. E. Veenhuis, and R. Brennan.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A072 555, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-2, January 1979. 17 p, 6 Fig, 4 Tab, 15 Ref.

Descriptors: *Water supply, *Water demand, *Reservoir operation, *Water delivery, Effects, Water quality, Water levels, Elevation, Hydrologic budget, Water storage, Streamflow, Water rights, Surface waters, Synthetic hydrology, Colorado River basin, Evaluation, *Dillon Reservoir(CO), *Hydrologic effects, *Water diversion.

Because of the increased demands for water in eastern Colorado, principally in the urbanizing Denver metropolitan area, increased diversions of water from Dillon Reservoir are planned. Estimates of end-of-month storage in Dillon Reservoir, assuming the reservoir was in place and 131,000 acre-feet of water were diverted from the reservoir each year, were reconstructed by mass balance for the 1931-77 water years. Based on the analysis, the annual maximum end-of-month drawdown below the elevation at full storage would have averaged 54 feet. The maximum end-of-month drawdown below the elevation at full storage would have been 171 feet. The mean-annual discharge-weighted dissolved-solids concentrations in the Colorado River near Glenwood Springs and Cameo, Colo., and Cisco, Utah, for the 1942-77 water years, were computed assuming an annual diversion of 131,000 acre-feet of water from Dillon Reservoir. The average increases in the dissolved-solids concentrations with the 131,000-acre-foot diversion were 15 to 16 milligrams per liter at the three sites. (Woodard-USGS)
W80-01429

PRELIMINARY DATA FOR MADISON LIMESTONE TEST WELL 3, NW1/4 SE1/4 SEC. 35, T. 2 N., R. 27 E., YELLOWSTONE COUNTY, MONTANA,
Geological Survey, Denver, CO. Water REsources Div.; Geological Survey, Huron, SD. Water Resources Div.; Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-01434

GROUND WATER IN THE VICINITY OF CAPULIN, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
D. L. Hart, Jr., and C. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 824, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-79, June 1979. 38 p, 11 Fig, 7 Tab, 20 Ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Water quality, *Potential water supply, *Aquifer characteristics, Hydrology, Water wells, Water yield, Water demand, Projections, New Mexico, *Colfax County(N Mex), *Capulin area(N Mex).

The alluvial deposits within a closed basin near Capulin, New Mexico, are estimated to have 189,000 acre-feet of water in storage. These deposits have an estimated average transmissivity of 400 feet squared per day and represent the major source of ground water. Well yields range from a few gallons per minute to as much as 900 gallons per minute, with average potential yields ranging from about 100 to 200 gallons per minute in areas of greatest saturated thickness. Additional large quantities of water are available for short-term supplies from the saturated basaltic cinders west and northwest of the town of Capulin. Wells completed in the cinders reportedly have produced as much as 2,000 gallons per minute. The chemical quality of water in the alluvium and cinder aquifers appears to be chemically satisfactory for municipal use. The ground water in storage is sufficient to supplement Raton, New Mexico's water needs to the year 2030 at the water demand rate projected by the Bureau of Reclamation. (Woodard-USGS)
W80-01592

6E. Water Law and Institutions

GROUND-WATER STORAGE FOR CALIFORNIA WATER PROJECT,
California State Dept. of Water Resources, Los Angeles. Southern District.
J. J. Coe.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR3, Proceedings Paper No 14832, p 305-315, September 1979. 5 Fig, 3 Ref.

Descriptors: *Artificial recharge, *Conjunctive use, *Legal aspects, *Inter-basin transfers, *California, *Inter-agencycooperation, Groundwater basins, Irrigation, Public utilities, Regional analysis, Water law, Water resource development, Management, State water plan.

Environmental opposition and escalated construction costs associated with construction of dams and reservoirs in Northern California have caused the California Department of Water Re soures to examine the feasibility of using groundwater basins in the San Joaquin Valley and Southern California to store State Water Project water during periods of above normal runoff in Southern California for later withdrawal and delivery in subsequent dry years. Conjunctive use of surface and groundwater is not a new concept. However, for many years, there has been a reluctance to initiate conjunctive use because of concerns over legal and institutional aspects such as: (1) What are the priorities between overlying users and public agencies to available storage space and what are the priorities between public agencies; (2) Who owns the water after it's spread or injected and placed in storage; (3) How should state and regional conjunctive use programs be made compatible with local water management operations. In California, two recent State Supreme Court decisions have provided some guidance. (Adams-ISWS)
W80-01282

REGIONAL FACTORS IN THE FORMATION OF THE FISHERMAN'S PROTECTIVE UNION OF NEWFOUNDLAND,
Toronto Univ. (Ontario).
R. J. Brym, and B. Neis.
Canadian Journal of Sociology, Vol 3, No 4, p 391-407, 1978. 4 Fig, 55 Ref.

Descriptors: *Labor unions, *Fish management, *Social aspects, *Political aspects, Regional economies, History, Labor unions, Economics, Fishermen, Social values, History, Fisheries, Canada, *Newfoundland Fishermens union.

Social-stryctyrak factors which produced regional variations in the level of support for the Fisherman's Protective Union (FPU) of Newfoundland (FPU), a populist movement of the 1910s and 1920s, are examined. Focusing on a single determinant of social power, the level of social organization, connections are demonstrated between different patterns of economic underdevelopment, of labor organization and collective political action on one hand, and between the social organization of authority and the suppression of political dissidence on the other. Fisherman apparently were affected by two broad types of organization. Only one, however, characterized by substantial

amounts of capital investment creating a concentrated work force, was conducive to collective political action. A principal opponent for the FPU, the church elite, was sufficiently organized to suppress potential fishermen involvement in the movement in all areas of the island except one. The combination of these two factors explains the relative success and failure of the FPU in cooperatives, abolishing the merchant's right to grade and thereby set the price for fish, regulating the fisheries, and eliminating the credit systems. (Luedtke-Wisconsin)
W80-01307

COMMUNITY INTERDEPENDENCE AND ENVIRONMENTAL QUALITY: PROBLEMS IN MANAGING NON-POINT POLLUTION,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
R. E. Rickson, C. E. Ramsey, and P. J. Nowak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116338, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota Report. November 1979. 28 p, 8 Tab, 60 Ref. OWRT A-032-MINN (1).

Descriptors: *Management, *Water quality *Water policy, Decision making, Knowledge, Self-interest.

Implementing environmental goals in a region requires coordination of community efforts. When communities have different interest, coordination is difficult. Residents are likely to respond on the basis of residential self-interest rather than regional 'interests'. Public responses, we argue, are influence by residential self-interest, knowledge and values, and the coordinating roles of local leaders. Two communities in a regional watershed were studied: one town and one rural. Data show that residential self-interest is important to public response, but its impact is limited by public knowledge and values. Leaders are found to occupy key positions; coordinating the flow of information within and between communities, and with outside agencies. (Blake-Minn)
W80-01380

WATER QUALITY MANAGEMENT PLAN: EXECUTIVE SUMMARY.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
For primary bibliographic entry see Field 5D.
W80-01391

WATER QUALITY MANAGEMENT PLAN: IMPLEMENTATION SUMMARY,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
For primary bibliographic entry see Field 5D.
W80-01392

WATER QUALITY AND AGRICULTURE: A MANAGEMENT PLAN,
North Carolina Soil and Water Conservation Commission, Raleigh. Div. of Land Resources.
For primary bibliographic entry see Field 5G.
W80-01393

WATER QUALITY AND WASTEWATER DISCHARGES: A MANAGEMENT PLAN.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
For primary bibliographic entry see Field 5D.
W80-01394

WATER QUALITY AND ON-SITE WASTEWATER DISPOSAL: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5D.
W80-01395

WATER QUALITY AND SOLID WASTE DISPOSAL: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5G.
W80-01397

WATER SUPPLY CONSTRAINTS ON NIGERIA'S ECONOMIC DEVELOPMENT: THE CASE OF ANAMBRA STATE,
Nigerian Inst. of Social and Economic Research, Ibadan
For primary bibliographic entry see Field 6D.
W80-01406

ECONOMIC AND LEGAL ENFORCEMENT MECHANISMS.
Proceedings of a Workshop held in Windsor, Ontario, February 21-22, 1977. International Joint Commission, Report No R-77-1, October 1977. 302 p. Bonner, P. A. (ed).

Descriptors: *Great Lakes, *Point pollution, *Nonpoint pollution, *Water policy, *Pollution abatement, *Regulation, *Economics, *Legal aspects, *Social aspects, *Nominal Group Technique, International Joint Commission, International commissions, Great Lakes region, Water pollution sources, Water pollution control, Non-structural alternatives, Administrative agencies, Canada, Governments, Methodology, Decision making, Jurisdiction, Political aspects, State jurisdiction, Federal jurisdiction.

A synthesized conclusion drawn from presentations given at a workshop on achieving improved water quality in the Great Lakes is that whether 'new' policy mechanisms are used or not, state, provincial, and federal pollution abatement agencies both in the U.S. and Canada should implement more rigorous, specific and effective enforcement measures in their relevant jurisdictions. In the case of point sources, municipal as well as industrial polluters should be given clear economic and legal incentives to reduce their pollution loads. For nonpoint sources and particularly agriculture, voluntary enforcement schemes should be reinforced with mandatory policies and programs which incorporate financial assistance. Fifteen speakers and panelists participated in the 2-day workshop, organized in separate point-source and nonpoint-source segments by the sponsoring Social Sciences, Economics, and Legal Aspects Committee (SSELA) of the Research Advisory Board of the International Joint Commission of Canada and the U.S. on the Great Lakes. The Nominal Group Technique (NGT), a process developed to elicit improved discussion participation in small-group meetings, was tested in workshop sessions. Conclusions: NGT is good for factual discussion/decision situations, for identifying problem/solution elements and for bringing different judgment factors together in one decision area; however, the technique does not work as well when alternative policy decisions must be judged for a single functional consideration. (Harris-Wisconsin)
W80-01467

ECONOMIC IMPACT OF PROPOSED BORON WATER QUALITY STANDARD FOR WOOD RIVER, R76-18,
Southern Illinois Univ. at Carbondale. Dept. of Thermal and Environmental Engineering.
C. B. Muchmore, and W. S. O'Brien.
Illinois Institute for Environmental Quality No 77/19, June 1977. 42 p, 4 Fig, 1 Tab, 26 Ref. 80.088.

Descriptors: *Boron, *Water quality standards, *Economic impact, *Wood River(IL), *Electric powerplants, Illinois, Water quality, Powerplants, Environmental effects, Effluents, Fly ash, Public health, Discharge(Water), Costs, Capital costs, Operating costs, Industries.

The Illinois Power Company, whose ash pond discharge frequently violates boron water quality standards, petitioned the Illinois Pollution Control Board to adopt a proposed change, R76-18, exempting a 0.9 mile section of the Wood River from current 1.0 mg/l boron standards and establishing 25 mg/l standards for that area. If the proposed change is denied, the least cost alternative is construction of a pipeline and pumping facilities to discharge ash pond effluent directly to the Mississippi River 0.9 miles away. Capital cost for the pipeline is estimated at $272,000 with annual operating costs $8,300; total number of annual costs are $33,600, resulting in an additional $0.10 cost to residential customers. Boron concentrations above 0.03-0.04 ppm cause boron toxicity problems in sensitive plants such as citris, violet, and pansy. For semi-tolerant species, boron concentrations of 1.0 to 2.0 ppm are allowed. A 0.3 mg/l boron standard for drinking water has been suggested because of long term adverse human health effects. However, this section of the Wood River flows through a highly industrialized area; its waters are not used for potable water supply, irrigation purposes, fishery, or public recreation. The proposed rule change would have no significant environmental costs or benefits to agriculture, commerce, industry, local government on the people of Illinois. (Danovich-Wisconsin)
W80-01468

THE SOCIAL AND POLITICAL MATRIX OF ENVIRONMENTAL ATTITUDES. AN ANALYSIS OF THE VOTE ON THE CALIFORNIA COASTAL ZONE REGULATION ACT,
Pennsylvania State Univ., University Park. Div. of Man-Environment Relations.
For primary bibliographic entry see Field 6B.
W80-01470

POLLUTION CONTROL: ECONOMISTS' VIEWS,
London School of Economics and Political Science (England).
A. Marin
The Three Banks Review, No 1212, p 21-41, March 1979.

Descriptors: *Pollution taxes(Charges), *Pollution abatement, *Economic justification, *Regulation, Water pollution control, Taxes, Non-structural alternatives, Monitoring, Control system, Inspection, Law enforcement, Penalties(Legal), Costs.

A study of the social control of individual pollution-causing activities by means of taxes and other charges as contrasted with quantitative pollution limits finds objections to charges as a control instrument, even though that approach is most suitable to the free market system prevalent in most western countries. Advantages of charges: (1) They lead to correct allocation of resources in that the full social costs of undertaking pollution-creating activities are balanced against the benefits. (2) Commercial firms or private individuals considering alternative practices which would lead to different levels of pollution may be induced to abate pollution up to the point where the cost of further abatement just equals the cost of the extra damage. (3) Decision-making in regard to pollution levels is decentralized and therefore easier to administer. (4) Where the central regulating authority is acting with incomplete knowledge in regard to optimal pollution levels, the desired reduction in pollution can be achieved at less cost to the community if charges are levied than if abatement is enforced through regulations. Disadvantages of charges: (1) Communal responsibility as expressed through mandated regulations is a stronger abatement inducement than reliance on individual self-interest. (2) Rather than minimizing costs of producing their output, many firms revise existing production processes and marketing practices when they are forced to do so. (3) A system of charges requires not only that emissions be continuously monitored but that a permanent record (and possibly a cumulative one) of a polluter's emissions be available to the inspectorate. (Harris-Wisconsin)
W80-01471

ENVIRONMENTAL PROTECTION IN COMECON MEMBER NATIONS,
B. Gorizontov, and V. Prokudin.
Problems of Economics, Vol 21, No 8, p 24-40, December 1978. 6 Ref. Translated from Okhrana

okruzhaiuschei sredy v stranakh-chlenakh SEV, Voprosy ekonomiki, No 4 p 68-76, 1978.

Descriptors: *Conservation, *Foreign countries, *Political aspects, *Comprehensive planning, *Environmental control, Pollution abatement, Russia, Poland, Regulation, Governments, Administration, Governmental interrelations, Legislation, Economics, Coordination, Management, Planning, Water policy, Control, Environment, Investment.

Substantial environmental protection results are achieved by cooperative efforts of COMECON member nations of eastern Europe. But at the same time, joint works and proper application of integrated planning programs are needed. This paper reviews environmental protection progress of communist countries. Socialist systems have potential for securing better effective solutions to environmental protection than potential for securing better effective solutions to environmental protection than capitalish approaches because of efficient, comprehensive state regulation on a planned bases. Socialist countries are establishing special state regulatory agencies and legislation is enacted on rational and comprehensive natural resource use. Economic growth and social development planning is closely interconnected with the environment. In 1976 capital investments in nature conservation in the USSR amounted to 1.755 billion rubles. In 1970 capital investment in environmental protection in Polish People's Republic represented 2.9% of total capital investment and 0.6% of national income. In 1974 COMECON member nations and Yugoslavia initiated a General Detailed Program of Cooperation on environmental protection and improvement. Tasks include waste-free technologies; pollution detection methods standardization; high-efficiency gas and water purification equipment; resolution of socioeconomic, educational, and legal problems; and basic exploratory research. (Danovich-Wisconsin)
W80-01472

TRANSFRONTIER POLLUTION IN INTERNATIONAL WATER BASINS,
Eidgenoessisches Amt fuer Umweltschutz, Bern (Switzerland).
A. Droz, and H. Smets.
Report, Organisation for Economic Cooperation and Development, Paris, 1978. 14 p.

Descriptors: *Water pollution control, *Governmental interrelations, *International commissions, International waters, Institutions, Organizations, Water pollution, Governments, Administration, Legal aspects, Planning, Conferences, International Joint Commission, Environmental effects, Professional personnel, Scientific personnel, Projects.

A seminar of the Organization for Economic Cooperation and Development held in Switzerland in June 1977 concluded that during the last 10 years international cooperation has been strengthened for solving transfrontier pollution problems in international water basins. More international commissions have been established, existing commissions were increasingly active and had taken on added responsibilities, and increasingly specific objectives, standards, and measurement programs were being adopted. While commissions vary in powers and aims, all have access to national technical experts for impartial advice. Ecological and economic effects should be included in preparing detailed action proposals to solve environmental problems and competent scientific advice should be obtained before adopting positions. The more data a commission has on its water basin discharges and water quality, the more that rational and effective action programs can be prepared. The U.S. and Canada provide the International Joint Commission (IJC) with all nationally available data. Financial and administrative details and methods of emergency aid for hydrocarbon pollution accidents should be agreed upon prior to any event eliminating action delays at crucial times. Some North American cases considered in discussions included IJC and Great Lakes Agreement Commission. European organizations range from the Saar and Rosselle Commission, to German-Dutch Frontier Commission, to Greek-Bulgarian rivers, to Finnish-Swedish Waters Commission. (Danovich-Wisconsin)
W80-01473

TRANSBOUNDARY GROUND WATER POLLUTION: SURVEY AND TRENDS IN TREATY LAW,
Fordham Univ., Bronx, NY. School of Law.
L. A. Teclaff, and E. Teclaff.
Natural Resources Journal, Vol 19, No 3, p 629-67, July 1979.

Descriptors: *Groundwater, *International law, *Treaties, Groundwater recharge, Groundwater resources, Groundwater availability, Aquifers, Water pollution, Water pollution sources, Water pollution control, United Nations.

Ground water accounts for 70% of the drinking water in member states of the European Economic Community, even more than that in Denmark, the Federal Republic of Germany, and ninety-three percent in Italy. According to the federal Environmental Protection Agency (EPA) half of all drinking water in the United States is from underground sources. Accessible ground water is already endangered and poses a threat to public health in parts of the United States and Europe, especially through pollution by toxic substances, hydrocarbons and nitrates. A detailed analysis is given of the pathways of groundwater contamination and the major sources of ground water pollution (agricultural, industrial, domestic and municipal). International treaties are surveyed which have dealt with ground water as related to surface water and pollution. Also analyzed are the current state of International conventional law, measures already in force or proposed in domestic legislation, and guidelines of international organizations for the harmonization of national laws. Existing treaties and institutions are far from adequate to cope with the serious problems posed by groundwater pollution. (Vloedman-Florida)
W80-01546

FEDERAL ENVIRONMENTAL REVIEW REQUIREMENTS OTHER THAN NEPA: THE EMERGING CHALLENGE,
Cleveland-Marshall Coll. of Law, OH.
R. H. Rosenberg, and A. H. Olson.
Cleveland State Law Review, Vol 27, No 2, p 195-229, 1978.

Descriptors: *Water treatment, *Water pollution, *Standards, *Water quality control, Judicial decisions, Water policy, Recreation, Coasts standards, Water law, Wild River Act.

The effect of specialized environmental review statutes on federal activity is discussed. It is assumed that they will complicate federal environmental review and planning processes because of their tendency to overlap with the National Environmental Policy Act and each other. Five major specialized environmental review statutes which affect the greatest number of federal activities are analyzed: (1) The 1958 Fish and Wilflife Coordination Act; (2) The 1973 Endangered Species Act; (3) The 1966 National Historic Preservation Act; (4) The 1974 Wild and Scenic Rivers Act; and (5) The 1972 Coastal Zone and Management Act. As to these statutes, there is commentary on existing judicial interpretations, identification of emerging trends in the law, and highlighting of problems arising from the proliferation of these types of statutes. (Walker-Florida)
W80-01547

FEDERAL ACQUISITION OF NON-RESERVED WATER RIGHTS AFTER NEW MEXICO,
B. A. Machmeier.
Stanford Law Review, Vol 31, No 5, p 885-911, May 1979.

Descriptors: *Indian reservations, *Water rights, *Federal-State water rights conflicts, Water allocation, State governments, Water law, Constitutional law, Forests.

Evaluated is the recent Supreme Court decision of United States V. New Mexico. That case decided that reserved water was available to the United States only to the extent that it is needed to accomplish the original purpose of the land withdrawal. The Court suggested that when reserved water is unavailable, federal agencies must abide by state water law and acquire water rights as any other public or private appropriator. The role of state law in federal water acquisition envisoned by the Court is unwarranted. Part one discusses the constitutional limits on Congressional power to acquire water. State law cannot limit this power. Private parties affected by the federal use may have a fifth amendment right to compensation. Part two looks at the water acquisition by federal agencies. Congress has the power to delegate its authority to acquire water rights outside of state law to federal agencies. It has specifically delegated this power to the Forest Service. (Walker-Florida)
W80-01548

THE ASSESSMENT OF POLLUTION DAMAGE TO AQUATIC RESOURCES: ALTERNATIVES TO THE TRIAL MODEL,
Environmental Protection Agency, Washington, DC.
R. A. Du Bey, and E. R. Fidell.
Santa Clara Law Review, Vol 19, No 3, p 641-80, Summer 1979.

Descriptors: *Water pollution, *Aquatic environment, *Compensation, *Damages, Federal government, State governments, Water law, Economics, Cost allocation, Cost analysis, Cost comparisons.

One basic weakness in a conservation system based wholly on economic motives is that most members of the land community have no economic value. This statement is equally applicable to aquatic resources, which is basically why no economic value has been fixed for aquatic resources. Consequently, no amount of public compensation funding under current law is guaranteed to go to those in fact injured by water pollution until the valuation problem has been resolved. The existing body of law regarding damage assessment are examined, including the common law approach and several state legislative schemes. The probable consequences of implementing a natural resource assessment scheme based on established natural resource damage assessment procedures and valuation tables are explored. Special attention is paid to the case of Commonwealth of Puerto Rico v. SS Zoe Colocotroni and Senate bill 2083, the 1978 Oil Pollution Liability and Compensation Act, which would establish a strict liability scheme. (Vloedman-Florida)
W80-01549

POLLUTION CONTROL AT THE MARITIME FRONTIER: THE LIMITS OF STATE EXTRATERRITORIAL POWER,
P. M. Greenwald.
Santa Clara Law Review, Vol 19, No 3, p 747-75, Summer 1979.

Descriptors: *State jurisdiction, *California, *Water pollution control, *Oceans, Coasts, International waters, Environmental control, Regulation, Legislation, Federal government, Federal jurisdiction, Ships.

Coastal states hold a unique position in the international community. They receive all of the benefits and burdens that sea-borne commerce provides; yet because of our federal system, they lack the power that all coastal nations wield to determine the territorial extent to which they may control that commerce. The extraterritorial applicability of state laws holds great significance especially in the field of environmental protection. California is currently grappling with the problem of controlling such extraterritorial polluters at sea as vessel traffic, drilling platforms, and lightening operations. The California Air Resources Board (ARB) has drafted a set of model rules to be adopted by its regional districts. These rules assert jurisdiction to regulate pollution sources located within 75 miles of shore. In the context of the ARB model rules, the following are examined: (1) the international law of jurisdiction over vessels on the high seas;

the constitutional limitations on state authority beyond territorial waters, and (3) the applicability of state environmental laws to drilling platforms and deepwater ports on the outer continental shelf. (Vloedman-Florida)
W80-01550

GENERAL ADJUDICATION OF WATER RIGHTS,
Ch 139, secs 1 thru 86, 1979 Ariz. Legis. Serv. 405 (West) to be codified in scattered sections of 1, 45 (Ariz. Rev. Stat.).

Descriptors: *Adjudication procedure, *Arizona, *Water rights, Administration, Surface waters, Groundwater, Colorado River, Permits, Legislation, Water law.

In 1979, the 34th legislature of the State of Arizona passed Senate Bill 1239, Waters-Administration of Water Laws; Appeals; Adjudication of Rights. The Act transfers from the State Land Department to the Arizona Water Commission all of the functions, powers contracts, judicial actions and data relating to the administration of surface water and groundwater laws. The general adjudication of water rights is moved from the Land Department and to the Superior Court. Decisions of the commission can be appealed to the Superior Court in the manner set out. Procedures are prescribed for adjudication in the Superior Court. A description is given of certain lands subject to sale in the dry bed of the Colorado River. The process for procurring water rights is also stated. (Walker-Florida)
W80-01551

THE ALLOCATION OF PERCOLATING WATER UNDER THE OKLAHOMA GROUND WATER LAW OF 1972,
Tulsa Univ., OK.
E. B. Jensen.
Tulsa Law Journal, Vol 14, No 3, p 437-76, 1979.

Descriptors: *Oklahoma, *Groundwater resources, *Water allocation(Policy), Prior appropriation, Property values, Water consumption, Water distribution, Water law, Percolating water, Economic efficiency.

The maximum annual yield of fresh ground water for the first ground water basin was determined by final order of the Oklahoma Water Resources Board. This order regulated the administration of ground water under the 1972 Oklahoma Groundwater Law (OGWL). The OGWL does not respond to the practical need of concentrating the privilege of water use in few enough hands. The amount which each of the privileged users is entitled to use is inadequate to obtain economic benefits. The problem with the OGWL is that it elevates property interests to such a high level that the practical value in the more arid regions is minimal. This conclusion is reached by tracing the history of Oklahoma water law and the distinction between property interests in water and regulation of water use. The effect of this distinction is present in the 1949 OGWL which is discussed and compared to the 1972 law. Also discussed are the protection of prior rights by the OGWL, a determination of maximum annual yield, and the changes in allocation based on new data. (Walker-Florida)
W80-01552

WATER MANAGEMENT OF THE FUTURE: A GROUNDWATER STORAGE PROGRAM FOR THE CALIFORNIA STATE WATER PROJECT,
California State Dept. of Water Resources, Sacramento.
R. B. Robie, and P. R. Donovan.
Pacific Law Journal, Vol 11, No 1, p 41-64, October 1979.

Descriptors: *Conjuctive use, *Water, *California, *Water management(Applied), Groundwater, Environmental effects, Storage, Cost comparisons, Water storage, Institutional constraints, Legislation.

Water supplies of the California State Water Project should be considered for a conjunctive use program. In this respect the underground storage of surface water supplies is advocated. The program's relative efficiency as to cost effectiveness and environmental impact is discussed. A theoretical model is provided to help identify the institutional, operational, and environmental factors that must be considered before a ground water storage program can be introduced. The proposed legislation of the California Governor's Commission is analyzed in light of major legal issues surrounding water storage priorities. A working ground water demonstration project is provided to show how a ground water storage program used in conjunction with surface water can work successfully. (Walker-Florida)
W80-01553

BEYOND SECTION 858: A PROPOSAL GROUND-WATER LIABILITY AND MANAGEMENT SYSTEM FOR THE EASTERN UNITED STATES,
National Energy Law and Policy Inst., OK.
J. S. Lowe, L. C. Ruedisili, and B. N. Graham.
Ecology Law Quarterly, Vol 8, No 1, p 131-61, 1979.

Descriptors: *Water allocation(Policy), *Water management(Applied), *Groundwater availability, Groundwater, Withdrawal, Beneficial use, Reasonable use, Water consumption, Water demand, Water rights.

The adoption of section 858 from the second Restatement of Torts is evaluated. The section addresses liability for withdrawal of ground water which results in the interference of another's beneficial land use. The value of the Restatement view is that it alters the American rule which offers and overlying landowner user a secure, almost absolute right, while providing tenuous protection to his neighbors. The American rule equates reasonable use with beneficial use of one's land. The Restatement view also embraces the concept of reasonableness, but it offers the overlying user more limited protection from liability. Problems of application and logic still remain. Section 858 assumes an abundance of water, but will be applied to disputes resulting from water shortages. There is substantial reliability on certainty which is unfair to individuals functioning within the economic system. The public interest in ground water resources is not protected. A system is proposed which tailors the western states' approach to meet eastern state conditions. Three possible systems are suggested which all attempt to permit development of the resources concommitant with protecting the resource. (Walker-Florida)
W80-01554

UNILATERAL ACTION VERSUS UNIVERSAL EVOLUTION OF SAFETY AND ENVIRONMENTAL PROTECTION STANDARDS IN MARITIME SHIPPING OF HAZARDOUS CARGOES,
D. A. Fitch.
Harvard International Law Journal, Vol 20, No 1, p 127-74, Winter 1979.

Descriptors: *Water quality standards, *International law, *Water pollution control, Hazards, Water law, Risks, Ships, Organizations, Standards, Safety.

The legal systems and measures, both international and national, through which nations have attempted to reduce the risks associated with oceanic shipping of hazardous cargoes is examined. The efforts of international organizations to develop generally acceptable international standards for maritime safety are deemed inadequate by the United States (US). The U.S. has unilaterally adopted stricter standards and enforcement measures. The relative merits of unilateral and universal standards for maritime pollution prevention and maritime safety are discussed. The elements involved in the choice between these two modes of action are evaluated. Adoption of similarly stricter national standards by other states would indicate that the U.S. standards represent a level of caution which is generally accepted internationally. Before this regression away from cooperative development of international law occurs, the competent international organization should adapt itself to respond more effectively to the needs of coastal and port states. (Walker-Florida)
W80-01555

OIL AND GAS OPERATION IN THE ATLANTIC OUTER CONTINENTAL SHELF: AN OVERVIEW OF THE REGULATORY AND LITIGATION-RELATED CONSTRAINTS TO DEVELOPMENT,
Le Boeuf, Lamb, Leiby and Mac Rae, Washington, DC.
G. C. Best
Connecticut Law Review, Vol 11, No 3, p 459-81, Spring 1979.

Descriptors: *Continental shelf, *Oil industry, *Federal-State water rights conflicts, Federal jurisdiction, State governments, Gasoline, Coasts, Judicial decisions, Submerged Lands Act, Legislation, Energy.

The regulatory and litigation-related constraints which inhibit the leasing and development of oil and gas in the Atlantic outer continental shelf (OCS) are described. The regional resistance to OCS leasing in the Atlantic is reviewed. The interplay between state and federal jurisdiction over OCS activities is discussed. Principal federal laws affecting offshore oil and gas operations include: (1) the 1953 Outer Continental Shelf Lands Act (OSCLA); (2) the Submerged Lands Act; (3) the Coastal Zone Management Act; and (4) the Coastal Land Impact Program. Recent litigation challenging the actions of federal regulatory authorities in the context of OCS and coastal zone administration is examined. These include suits brought by Suffolk County and Massachusetts to prevent the Interior Department from proceeding with the Baltimore Canyon and Georges Bank lease sales, and those brought by oil companies to injoin the National Oceanic and Atmospheric Administration's approval of the California and Massachusetts Coastal Zone Management Programs. Certain features of the OCSLA amendments and the increase in the number of interests groups indicate that litigation will increase in this area. (Vloedman-Florida)
W80-01556

CLEAN WATER ACT, RSOURCE CONSERVATION AND RECOVERY ACT AND CONTROLS ON WETLANDS AND THE COASTAL ZONE,
J. Quarles.
Federal Regulation of New Industrial Plants, Monograph No 28, p 22-51, Environment Reporter, Vol 10, No 1, May 4, 1979.

Descriptors: *Water pollution control, *Water quality standards, *Water treatment, Permits, Solid wastes, Wastes, Wetlands, Standards, Dredging, Navigable waters, Coasts

The Clean Water Act prohibits any discharge into public waters without a permit. Stringent pollution control requirements are placed on all discharges. New source performance standards (NSPS) apply to plants beginning construction after the standards have been promulgated. Environmental impact statements (EIS) are required before the federal Environmental Protection Agency issues a permit to a plant subject to NSPS. Applicaton procedures for permits, modifications and discharges into municipal systems are explained. The Resource Conservation and Recovery Act (RCRA) imposes certain requirements on all solid waste disposal, but focuses primarily on hazardous waste. A permit program was created covering facilities for hazardous waste disposal and a system from generation to disposal. Under the wetlands and coastal zone controls, Corps of Engineers permit is required for any dredge and fill project in navigable waters. An EIS may be required also. There is a strong national policy against filling of wetlands. The 1972 Coastal Zone Management Act provides federal funds for state programs and requires a federal permit applicant to comply with state requirements. (Quarles-Florida)

W80-01557

ELECTRICAL POWER COMMITTEE (ANNUAL REPORT): PART II B. CLEAN WATER ACT (CWA) DEVELOPMENTS,
American Bar Association, Washington, DC. Natural Resources Law Section.
Natural Resources Lawyer, Vol 12, No 1, p 19-33, 1979.

Descriptors: *Water quality control, *Nuclear power plants, *Water pollution standards, Judicial decisions, Permits, Planning, Pollutants, Standards, Regulation, Effluents.

There have been numerous recent judicial decisions dealing with the Clean Water Act (CWA). The federal Environmental Protection Agency (EPA) has continued its development of thermal effluent limitations guidelines in response to a federal court decision. Development regulation settling ocean discharge criteria are also proceedings. The EPA has continued its review of best available technology requirements and effluent limitations guidelines for toxic substances for the steam-electric category pursuant to a settlement agreement. Secion 311 of the CWA relating to hazardous substances regulations was amended after a federal court set aside previous EPA regulations. The EPA is required by one case to develop water quality criteria for sixty-five toxic pollutants. EPA began wholesale reorganization and reform of the National Pollutant Discharge Elimination System procedural rules. This reform and changes in the program due to judicial decisions are reviewed. The Nuclear Regulatory Commission has been active recently in interpretation of its role in evaluating aquatic environmental impacts when licensing nuclear power plants. The considerable enforcement litigation under the CWA in 1978 is reviewed. (Quarles-Florida)
W80-01558

COASTAL LAND PRESERVATION: OBSTACLES TO EFFECTIVE STATE ACTION,
D. Pool.
Columbia Journal of Environmental Law, Vol 4, No 2, p 254-73, Spring 1978.

Descriptors: *Coasts, *Shore protection, *State governments, Legislation, Regulation, Environmental control, Zoning, Public lands, Public access, Shores, Wetlands.

In recent years, population pressures, changing recreation patterns and industrial growth have intensified demand for shorefront areas. Concurrently, the need to protect coastal plants and wildlife and the supporting terrain has become increasingly apparent. States, which continue to retain primary responsibility for shorelines, have enacted legislation to meet the threat to coastal ecology. In some cases, this has involved heavy reliance on local zoning or a virtually categorical prohibition of development in specified coastal areas. In other states, legislatures have adopted sophisticated and comprehensive programs of coastal development, which balance preservation with controlled development. Substantial legal challenges have mounted against legislation of both types. The solution offered here incorporates features of traditional zoning law and the public trust doctrine. Zoning can provide a helpful framework for sustaining the substantive purposes of coastal area regulation. The public trust doctrine deals specifically with the state and public interest in coastal areas, offering an historically valid method of protecting them. (Vloedman-Florida)
W80-01559

MARINE RESOURCES COMMITTEE (ANNUAL REPORT),
American Bar Association, Washington, DC. Natural Resouces Law Section.
Natural Resources Lawyer, Vol 12, No 1, p 127-31, 1979.

Descriptors: *Continental shelf, *Oil pollution, *Resources development, Oil spills, Resources, Federal Government, Oceans, Legislation, Judicial decisions, Leases.

In 1978 Congress amended the 1953 Outer Continental Shelf Lands Act. These amendments and judicial activity relating to the Act are reviewed. Provisions added to the Act include: (1) Specific guidelines with respect to the promulgation of regulations concerning operations on the Outer Continental Shelf (OCS); (2) Several newly specificed bidding schemes; (3) Provisions regarding lease terms; and (4) Detailed requirements for exploration plans. The Act now requires the inclusion of specific subjects in the Secretary's Annual Report concerning learning and production on the OCS. In addition to the above amendments, 13 new sections were added to the Act which include: (1) OCS leasing program which will be coordinated with affected states and local governments; (2) Procedures for citizen enforcement of the act through litigation; (3) Procedures concerning oil and gas development; and (4) A grant to the federal government of the right to obtain its royalty in the purchase and disposition of oil and gas. Oil spills procedures and a fisherman's contingency fund were also established. (Quarles-Florida)
W80-01560

NATIONAL OCEAN POLLUTION RESEARCH AND DEVELOPMENT AND MONITORING ACT OF 1978-LEGISLATIVE HISTORY.
H.R. Rep. No 626, 95th Cong., 2nd Sess. (1978) reprinted in 5 U.S. Code Cong. and Ad. News 1258 (1978).

Descriptors: *Oceans, *Oil pollution, *Research and development, *Sewage sludge, Legislation, Legal aspects, Administrative agencies, Administrative costs, Seashores, Sewage disposals.

This House Report, 95-626-Part One, on the 1978 National Ocean Pollution Research and Development and Monitoring Planning Act contains: (1) The Bill's Purpose; (2) Committee Action; (3) The Background and Need for the Legislation; (4) An Explanation of the Bill; (5) Committee Views; (6) Cost and Budget Data; (7) Oversight Findings and Recommendations; and (8) The Congressional Budget Office Cost Estimate. The Act has two main purposes. The first is to establish a comprehensive five-year federal plan for environmental research and development related to marine pollution, with particular emphasis on the inputs, fates and effects of petroleum, sewage sledge, and other pollutants in the marine environment. The second is to designate the National Oceanic and Atmospheric Administration as the lead federal agency for marine pollution environmental research and development. The 1967 Torrey Canyon oil spill ignited an ever increasing awareness of the potential hazards of accidental and willfull discharges of pollutants into the marine environment. The failing of current federal marine environment research is the lack of efforts in determining the long-term fates and effects of various pollutants. (MacGregor-Florida)
W80-01561

SPILLING OIL MAY BE HAZARDOUS TO YOUR WEALTH,
R. L. Puglisi.
Natural Resources Journal, Vol 19, No 3, p 735-52, July 1979.

Descriptors: *Federal Water Pollution Control Act, *Oil pollution, *Oil spills, Water pollution, Water quality control, Oceans, Water pollution services, Water pollution control, Water quality regulation.

Section 1321 of the Federal Water Pollution Control Act Amendments gives the Federal government comprehensive power regarding the discharge of oil and other hazardous substances. Section 1321 provides for penalties and clean-up expenses, and promotes a co-operative federal attitude to encourage state participation in oil discharge clean-up and prevention. The article focuses on subsections (b), (c), (f), (i) and (o) of Section 1321 which seems to be the most important in providing a systematic framework for penalty imposition. The Section defers to the President to determine 'harmful quantities'. The Administration has determined that discharges of oil which cause a film of sheen upon or discoloration of the surface water are harmful. The section provides for a Nation Contingency Plan to effectuate clean-up of spills which pose a threat to the general welfare. The federal government is responsible for initial clean-up but may recover such costs and actual expense from the party deemed liable. More prosecutions under the section are foreseen due to greater quantities of oil and its products being transported annually. (Corey-Florida)
W80-01562

OPTIONS FOR CONTROLLING NON-POINT SOURCE WATER POLLUTION: A LEGAL PERSPECTIVE,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
D. L. Uchtmann, and W. D. Seitz.
Natural Resources Journal, Vol 19, No 3, p 587-609, July 1979.

Descriptors: *Sedimentation, *Soil conservation, *Nitrogen, *Water pollution control, Leaching(Nitrogen), Erosion, Federal Water Pollution Control Act, Agricultural runoff, Constitutional law, Legal aspects.

A legal analysis is given of various alternative approaches for controlling agricultural non-point pollution sources for compliance with Section 208 of the 1972 Federal Water Pollution Control Act Amendments. The control policies discussed represent a reasonable range of alternatives, including programs that relay on general education and voluntary and mandatory participation of farm operators. The control of most plan nutrients is discussed in the context of erosion and sedimentation control programs with nitrogen control receiving special attention. Voluntary sedimentation control programs include educational, cost-sharing and tax incentive policies that would be implemented on a state-federal cooperative level. Mandatory sedimentation control programs must be carefully considered in light of Fifth Amendment taking, reasonable regulation and public purpose doctrines since row crop restrictions are an enormous burden on farmers. Nitrogen Control Programs could be enacted on a state level to protect the general welfare and water quality. A per-acre nitrogen restriction is advocated if it is established that nitrogen in water is a significant health hazard. The final mix of the alternatives put forth to control agricultural nonpoint sources of pollution will probably be determined by legislative and administrative procedures. (Corey-Florida)
W80-01563

GEOTHERMAL RESOURCES,
Ch 87, Secs 1 thru 17, 1979 Ariz. Legis. Serv. 354 (West) (to be codified in scattered sections of 27, 37, 42 and 43 Ariz. Rev. Stat.).

Descriptors: *Geothermal resources, *Arizona, *Water resources development, Water resources, Legal aspects, Geothermal studies, Groundwater, Legislation, Leases, Energy.

The Arizona legislature has adopted legislation to provide for the development of geothermal resources. The act exempts geothermal resources and development from the states' water laws, except where such resources are comingled with surface water or groundwater or where there is an impairment of the groundwater supply. In order to foster geothermal development the act authorizes the state land department to lease land and promulgate rules and regulations governing geothermal development. The law specifies the department procedures for receiving and reviewing lease applications. It also requires leases to contain certain provisions, such as, a royalty payment by lessee of not less than 12 1/2 percent of the gross value of the resources, and a minimum of 10 year term. Other provisions of the law deal with surface use by the lessee, assignment of leases, and surrender of lands held under lease. (Mac Gregor-Florida)
W80-01564

GROUNDWATER TRANSFERS,
Ch. 29 Secs, 1 thru 11, 1977 Ariz. Legis. Serv. 103

(West) (to be codified in scattered sections of 45 Ariz. Rev. Stat.).

Descriptors: *Arizona, *Groundwater availability, *Groundwater resources, Groundwater movement, Transfer, Comprehensive planning, Management, Water rights, Legislation.

The Arizona Legislature determined that a strict application of existing law preventing groundwater transfer would jeapordize the economy and well-being of its people. It was also found that the rapid depletion of groundwater resources necessitated a long-range comprehensive plan for groundwater management. Senate Bill 1391 (Groundwater-Transfers) was passed. The Act provides: (1) the procedure for transferring groundwater from and within critical groundwater areas; (2) for certain rights, liabilities, and remedies relative to groundwater; (3) for disposition of municipal treatment plant water; and (4) for a moratorium on designating new critical groundwater areas. (Walker-Florida)
W80-01565

OCEANS REPORT,
A. D. Wiener.
Lawyer of the Americas, Vol 11, No 1, p 195-204, Spring 1979.

Descriptors: *Oceans, *Continental shelf, *Resource development, Fishing, Antarctic, Transportation, Governmental interrelations, Pollution, Mining, Federal Government, Legislation.

Recent governmental activity is examined in these areas: (1) government reorganization; (2) marine pollution; (3) fishing; (4) antarctic resources; (5) marine transportation; and (6) deep sea mining. A Department of Commerce study, entitled 'US Oceans Policy in the 1970's; State's and Issues,' listed three major ocean policy issues as: (1) the need for a nations ocean policy framework to be used for longterm management of coastal and ocean resources; (2) the extent to which the United States will exercise jurisdiction over ocean and seabed resources; and (3) the need for national policy in developing ocean and coastal resources. The 1978 Outer Continental Shelf Lands Act Amendments streamline the procedures required for obtaining private leases to exploit mineral resources on the outer continental shelf and also mandate Interior Department supervision of oil and gas drilling activities to insure that air quality standards are not violated. In 1978, the U.S. signed agreements to set maritime boundaries with Mexico, Venezuela and Cuba. The U.S. and Canada agreed to a fisheries treaty for the east coast but will refer disagreements over boundary-setting in the Gulf of Maine to a third party for binding arbitration. (Vloedman-Florida)
W80-01566

THE CONTROL OF TOXIC POLLUTANTS UNDER THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972,
Iowa Univ., Iowa City.
K. L. Hall.
Iowa Law Review, Vol 63, No 3, p 609-47, February 1978.

Descriptors: *Toxins, *Federal Water Pollution Control Act, *Water quality standards, Water pollution sources, Water Quality Act, Water quality control, Federal Government, Industrial wastes, Effluents.

In enacting the 1972 Federal Water Pollution Control Act Amendments, Congress intended to create a comprehensive scheme to restore and maintain the chemical, physical and biological integrity of the nation's waters. Included in the scheme were controls on the discharge of toxic water pollutants. The control on the discharge of toxic water pollutants to date has not been as effective as Congress intended. As a result of the settlement of law suits initiated by the Natural Resources Defense Council and other environmental groups, EPA has now set a new course for the effective regulation of toxic water pollutants. The consent decree in that settlement signed by environmental groups, EPA, and one industry intervenor mandated that EPA promulgate limitations to control sixty-five toxic pollutants for twenty one key industrial groups. The limitations are to be achieved by July 1, 1983. The settlement agreement and the provision of the Clean Water Act, mark the beginning of a program, which, if aggressively implemented and enforced, will result in the control of toxic water pollution and the return of clean, healthful water. (Vloedman-Florida)
W80-01567

THE FRESHWATER WETLANDS ACT: PERMISSIVE REGULATION VS. CONSTRUCTIVE TAKING,
E. J. Rizzo.
Albany Law Review, Vol 43, No 2, p 295-321, Winter 1979.

Descriptors: *New York, *Freshwater wetlands, *Eminent domain, Administrative agencies, Judicial decisions, Wetlands, Legal aspects, Land use, Land management, Land development.

The New York legislature has enacted a law to protect the state's freshwater wetlands. The law is carried out through an extensive system of land use regulations and a permit program administered by the state's Department of Environmental Conservation. The net result is the virtual prohibition of all development on wetlands within the act's jurisdiction, unless the Department issues a permit. A question is raised as to whether the act constitutes a taking of property without just compensation. The Act's provisions are examined. Court decisions on the taking issue from around the country are reviewed. A recent New York case which found the act effected a taking is also considered. The act is necessary and contains safeguards which ensure its constitutionality. (MacGregor-Florida)
W80-01568

FEDERALISM IN THE COASTAL ZONE: THREE MODELS OF STATE JURISDICTION AND CONTROL,
North Carolina Univ. at Chapel Hills.
T. J. Schoenbaum, and F. Parker, Jr.
North Carolina Law Review, Vol 57, No 2, p 231-60, February, 1979.

Descriptors: *Coastal zone, *Governmental interrelations, *Land management, *State jurisdiction, Administrative agencies, State governments, Coastal plains, Legal aspects, Federal Water Pollution Control Act, Federal government, Land use.

The federal government has recently asserted considerable jurisdiction over coastal zones. However, federalism does still exist in coastal management. The federal legislation has opened new opportunities, although it requires states to exercise or ease their responsibilities. The ways states may control their own coastal zones is analyzed. A state may work through a grant of power under federal law by, for example, adapting water quality standards under the Federal Water Pollution Control Act (FWPCA). Under the Coastal Zone Management Act, states can control federal activities in the coastal zone because the law requires federal agencies to act consistently with approved state management programs. Other examples are given of opportunities for state control. Within the framework of federal law, the states will play the dominant role in determining the future of the coastal zone. (MacGregor-Florida)
W80-01569

FLOOD CONTROL-RELOCATION,
Ch 217, secs 1 thru 15, 1979 Ariz. Legis. Serv. 967 (West) (to be codified in scattered sections of 26, 37, and 45 Ariz. Rev. Stats.).

Descriptors: *Arizona, *Flood control, *Relocation, Floods, Loans, Flood protection, Flood plains, Legislation, Land classification.

In 1979, the Arizona legislature passed House Bill 2457, Flood Control-Relocation; Land exchange. The Act provides for; (1) a flood relocation and state land exchange program, (2) a floodplain land exchange fund; (3) powers of the Arizona Water Commission; (4) the perfection and enforcement of lines for remedial measure employed by the state engineer relative to dams; (5) powers of county and special flood control districts; (6) raising of the levy limitation for special flood control districts; (7) items which qualify as compensable costs under the state flood control assistance program; (8) amounts of limitations on and eligibility for alternative flood control assistance; (9) flood control bans to certain flood control districts; (10) terms and conditions of such loans; (11) flood control loan fund; and (12) a restriction on use of certain monies appropriated to the alternative flood control assistance fund. (Walker-Florida)
W80-01570

NATIONAL OCEAN POLLUTION RESEARCH AND DEVELOPMENT AND MONITORING PLANNING ACT OF 1978,
Act of May 8, 1978. Pub. L. No 95-213, 92 Stat. 228, 5 U.S. Code Cong. and Ad. News (1978) (codified at 33 U.S.C. 17o1 et. seq.).

Descriptors: *Oceans, *Water pollution, *Research and development, Legislation, Oil pollution, Legal aspects, Administrative agencies, Administrative costs, Seashores, Sewage sludge, Sewage disposal.

The 1978 National Ocean Pollution Research and Development and Monitoring Planning Act creates a comprehensive 5-year plan for federal oceanic activities; it provides for information gathering; and it designates the National Oceanic and Atmospheric Administration as the agency in charge. The 5-year plan must; (1) identify national needs and problems which relates to specific aspects of ocean pollution; (2) establish the priority in which those needs should be met and the problems solved; and (3) contain a detailed explanation of any revisions made. The Act also provides financial assistance for research in ocean pollution, and directs the agency administraton to establish an ocean pollution research program. (Mac Gregor-Florida)
W80-01571

AN ANALYSIS OF SECTION 208 OF THE FWPCA AMENDMENTS OF 1972 AND A SUGGESTED MODEL SURFACE WATER RUNOFF ORDINANCE,
R. Bush.
Available from Eastern Water Law Center, University of Florida, Gainesville, 32611. 131 p, 2 App, $5.24. (1978).

Descriptors: *Florida, *Federal Water Pollution Control Act, *Surface runoff, Water management, Drainage districts, Drainage practices, Water treatment, Water quality control, Water quality standards, Water pollution control.

Proper land use regulation and enlightened water quality management can substantially avoid the adverse environmental impacts associated with surface water runoff. This Model Surface Water Runoff Control Ordinance demonstrates a realistic implementation of a harmonious relationship between continued development and the natural environment. This ordinance is suggested for the Melbourne-Tillman Drainage District in Brevard County, Florida to alleviate the water problems while meeting the Section 208 requirements of the 1972 Federal Water Pollution Control Act. Section 208 ties together many of the Acts provisions water control planning provisions and greatly affects the treatment and management of surface water runoff. Section 208 planning is done on an areawide basis. Funding is provided for a two-year planning process which must address the problems of both point and non-point source water pollution. Implementaion of the plan may be the responsibility of existing or newly created local, regional of state agencies. The Act has many enforcement procedures if violation of a permit, a standard or limitation occurs. (Corey-Florida)
W80-01572

WHAT POSSIBILITIES EXIST FOR LOCAL LEGISLATION TO ASSIST IN CONTROLLING

LAND USE DEVELOPMENT (SPECIAL TREATMENT DISTRICT),
J. Mulligan.
Available from Eastern Water Law Center, University of Florida, Gainesville, 32611. 65 p, 3 App, $2.60. (1978).

Descriptors: *Land development, *Florida, *Land use, Land classification, Ecology, Eminent domain, Environmental control, Local governments, Zoning, Regulation.

Special Treatment (ST) areas are designated where an areas essential ecology cannot be adequately protected under conventional zoning regulations. This land use control device is in effect in Collier County, Florida and could prevent potentially harmful development from taking place in other environmentally endangered areas. To enact such legislation local government must have the power to regulate land use such as Florida's Municipal Home Rules Power Act. The regulations must have sufficient permit standards and must avoid the most serious problem of not effectrating a taking of private property. ST areas are chosen upon consideration of elevation, soil, structure, vegetation and natural conditions. The key element of the ST program of Collier county is Transferable Development Rights. This allows landowners to conform to the necessary new regulations or to transfer them 'residential density credit' to another property. This concept separates the right to develop land from the ownership of the land itself. Many conditions and regulations attach to such a land use program. The major attraction lies in offsetting the economic hardship to the landowners as a result of a resource protective program. (Corey-Florida)
W80-01573

WATER-SUPPLY CONSIDERATIONS RE PALM BAY, FLORIDA,
A. Draves.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611. 70 p, $2.80. (1978).

Descriptors: *Florida, *Water managemant(Applied), *Water resources, *Water supply development, Drainage districts, Shallow aquifers, Artesian wells, Water demand, Water resources development, Water policy, Water supply.

General Development Corporation is developing Palm Bay, a large residential community in Brevard County, Florida. Palm Bay is plagued with water problems including quality, supply, exploitation, and state and local regulation. Any withdrawal or use program must be limited to such uses or withdrawal capable of perpetual support. This reasonable use approach is mandatory in Palm Bay where some supply sources have been diminished in capacity to the point of permanent damange. The primary cause of the endangered water supply is the overdrainage of the Melbourne-Tillman Drainage District. The Florida legislature mandates utmost cooperation between municipalities, counties, water management districts and the Department of Environmental Regulation in seeking to utilize all practical means of supplying water from surface and ground sources. Regional water supply authorities have been given water management authority to levy taxes, exercise eminent domain and other powers to alleviate the water problems. Florida case law could support a permit system for water use as legislatively intended. This could have drastic effects on common-law, riparian reasonable use doctrines. Suggested approaches of obtaining additional water in Palm Bay include injection of freshwater into the Florida aquifer and impoundment of excess waters. (Corey-Florida)
W80-01574

A DWINDLING WATER SUPPLY AND THE INDIAN STRUGGLE TO RETAIN ABORIGINAL AND WINTERS DOCTRINE WATER RIGHTS.
United Effort Trust, Inc., Washington, DC.
American Indian Journal, Vol 4, No 12, p 35-44, December 1978.

Descriptors: *Water supply development, *Indian reservations, *Water allocation(Policy), Water rights, Water supply, Indians, Legislation, Judicial decisions, Federal government, Economic impact, Economic justification.

In order to develop their lands the American Indians need water. There is an adequate body of law, if properly administered, to protect Indian water rights, and thus allow for development. The Winter's doctrine is one example. In the Winters Case the United States Supreme Court held the Indians had by their treaties, retained rights to their reservation's water. Under Western water law of prior appropriation the Court's recognition of Indian water claims meant the Indians water rights took priority over all others. As a reaction against Winters and other such law, legislation is being proposed to deprive the Indians of their rights. Included is a reprint of a commentary on such a piece of legislation. Water policy proposals by President Carter and the Comptroller General are also analyzed. (MacGregor-Florida)
W80-01576

THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM IN ILLINOIS: THE STATE ASSUMES DIRECT AUTHORITY,
Environmental Protection Agency, Chicago, IL. Enforcement Div.
G. C. Ginsberg, and R. M. Harsch.
De Paul Law Review, Vol 27, No 3, p 739-60, Spring 1978.

Descriptors: *Illinois, *Waste water treatment, *Federal Water Pollution Control Act, Federal Government, Legislation, Permits, Pollutants, Water pollution control, State governments, Water quality standards.

Congressional intent that the states should assume primary responsibility for controlling water pollution within their boundaries is expressed several times in the Clean Water Act, and evidenced by the National Pollutant Discharge Elimination System (NPDES) permit program. The EPA transferred NPDES authority to Illinois in October 1977. Discussed are NPDES permit program, Illinois' permit program prior to adoption of NPDES, and how Illinois overcame the obstacles which inhibited assumption of NPDES authority for five years. Although several problems have resulted in a slowdown in permit processing and enforcement, Illinois has the necessary regulatory mechanisms to satisfactorily administer the state's water pollution control program. (Vloedman-Florida)
W80-01577

UNITED STATES INTERESTS AND THE LAW OF THE SEA,
E. L. Richardson.
Lawyer of the Americas, Vol 10, No 3, p 651-57, Winter 1978.

Descriptors: *United Nations, *Law of the sea, *International waters, United States, Oceans, Continental shelf, Marine geology, Commercial fishing, Foreign trade, Mining, Resources development.

In 1973, the Third United Nations Conference on the Law of the Sea (LOS) began the task of developing a comprehensive legal regime to govern the worlds oceans. The United States (US) has been guided in its negotations by seven major U.S. concerns: (1) global order; (2) mineral resources of the deep sea bed; (3) nonliving resources of the continental shelf, (4) living resources; (5) marine sicentific research; (6) protection of the marine environment; and (7) commerce and national security. To achieve stability, predictability, and order in world affairs, the U.S. has advocated the inclusion in the LOS treaty of a system of compulsory and binding dispute settlement. Since about 60% of the world's oil and gas reserves are in the continental margin and since the U.S. has a broad continental margin, we have a significant interest in determining the extent of each nation's coastal jurisdiction. The negotiating text before the Conference adequately represents the U.S. major concerns except for the development of deep seabed mineral resources. The seabed mining test must be improved before the U.S. can approve the treaty. (Vloedman-Florida)
W80-01578

ACCOMMODATION OF INDIAN TREATY RIGHTS IN AN INTERNATIONAL FISHERY: AN INTERNATIONAL PROBLEM BEGGING FOR AN INTERNATIONAL SOLUTION.
K. E. Petty.
Washington Law Review, Vol 54, No 2, p 403-58, March 1979.

Descriptors: *Pacific Northwest U.S., *Canada, *United States, *Indian reservation, Fish conservation, Fish management, Fish migration, Salmon, Fisheries, International Commission, International Law, Treaties.

The anadromous fish resources of the Pacific Northwest have been threatened for decades by an oversized fleet and by regulatory complexities and uncertainties. The United States now faces a dilemma which results from having treaties with two different signatories, Canada and native Northwest Indians. The Steven treaties guaranteed Washington Indian tribes 50% of the harvestable fish returning to their traditional hunting grounds. These fishing rights were reaffirmed in a 1974 U.S. District Court decision in United States v. Washington. The United States has also entered into a treaty with Canada providing for joint management of the fishing through the International Pacific Salmon Fisheries Commission. The commission was formed to achieve the purpose of protection, preservation and extension of the sockeye and pink salmon fisheries in the Fraser River System. The future cooperation between the United States and Canada has been threatened by their differing policies with respect to their native Indians. This is critical since the international nature of the salmon migration makes management dependent on American and Canadian cooperation. If Indian treaty rights are implimented too hastily, the result may be Canadian alienation. (Vloedman-Florida)
W80-01579

THE PROMISE OF DEEP SEA MINING,
National Oceanic and Atmospheric Administration, Washington, DC.
R. A. Frank.
Mining Congress Journal, Vol 64, No 2, p 73-74, 121-22, February, 1978.

Descriptors: *Mining, *Beds under water, *International waters, *Resource development, Natural resources, Legal aspects, Environmental effects, Federal government, Oceans, Research and development, Foreign countries, United Nations.

Deep seabed mineral development is entering a critical period where substantial progress can occur. The Law of the Sea Conference (LCS) and both the executive and legislative branches of the United States government have been assessing possible actions. Uncertainties are the reason for caution. Environmentalists are conerned about the impact of the retrieval and processing of the orerich nodules. These uncertainties are not a basis for not proceeding, but are a warning that technological development and exploitation must proceeed concomitantly with environmental analysis. The LCS negotiations are tied indelibly to deep sea mining. In view of the disappointing result in the deep seabed negotiations of conference sessions, President Carter has decided there is no reason to delay domestic seabed mining legislation. There is additional concern that the LCS Treaty could impede research and hinder ocean development. It is feared the seabed authority established in the present text of the LCS Treaty will lead to fewer benefits for developed and devloping countris. (Ewing-Florida)
W80-01580

6F. Nonstructural Alternatives

AN ASSESSMENT OF SOME ECONOMIC EFFECTS OF FIA LAND USE REQUIREMENTS

ON URBAN COASTAL ZONE DEVELOPMENT,
Mississippi State Univ., Mississippi State. Div of Business Research.
L. R. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116262, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Report, October 1979. 61 p, 2 Fig, 15 Tab, 16 Ref. OWRT A-127-MISS (1), 14-34-0001-9026.

Descriptors: *Economic impact, *Floodplain insurance, *Floodplain zoning, *Land use, *Coastal structures, *Urban sociology, Economic impact, Evaluation, Flood control, Construction costs, Community development, Land development, Property values, Employment, *Urban coastal floodplains, *Mississippi Gulf Coast, *Biloxi(MS), *Floodplain ordinances, *FIA land use criteria, National Flood Insurance Program, Land values, Property taxes.

Land use requirements for eligibility in the National Flood Insurance Program have not caused any significant decreases in total annual construction in urban coastal floodplains along the Mississippi Coast. Construction activity in Zone A has continued at high levels. Relativey high cost of elevating residential structures, along with other factors unrelated to ordinances, have caused some relocation of new construction to other areas of communities. Inability to construct commercial structures to comply with ordinances and maintain functional utility has prevented some commercial construction. Construction employment impacts have been negligible. Values of land and existing structures have increased in communities, but increases have been less in Zone A. Total county construction employment and income have not been affected by ordinances. In the typical community of Biloxi, less than half of total new construction in Zone A is actually regulated due to exemptions for repairing, remodeling, etc., not exceeding 50% of structure value. In this community, construction of regulated new structures decreased slightly, but patterns in non-residential new structures did not confirm any decrease. Total construction in Biloxi has increased since ordinances were implemented.
W80-01381

THE SOCIAL AND POLITICAL MATRIX OF ENVIRONMENTAL ATTITUDES. AN ANALYSIS OF THE VOTE ON THE CALIFORNIA COASTAL ZONE REGULATION ACT,
Pennsylvania State Univ., University Park. Div. of Man-Environment Relations.
For primary bibliographic entry see Field 6B.
W80-01470

THE FRESHWATER WETLANDS ACT: PERMISSIVE REGULATION VS. CONSTRUCTIVE TAKING,
For primary bibliographic entry see Field 6E.
W80-01568

6G. Ecologic Impact Of Water Development

MANAGEMENT ASPECTS OF FISHPOND DRAINAGE,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
S. Hejny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 399-403, 1978. 4 Fig.

Descriptors: *Marsh management, *Fish management, *Drainage effects, *Ponds, Wetlands, Freshwater marshes, Marsh plants, Marshes, Wildlife Muskrats, Farm ponds, Wildlife management, Water levels, Drainage practices.

Summer drainage of fishponds reduces the sedimentation of both antochthonous and allochthonous organogenous materials, and favors the aeration of the entire fishpond bottom soil complex. Rapid mineralization of the whole complex of organic matter induced by summer drainage slows down the penetration of helophytes into the open water. Summer drainage is important for exploited or cultivated reed-belts as it brings about a retreat of the muskrat populations for several years. Winter drainage is used to control certain aquatic and littoral macrophytes by frost damage to their rhizomes situated near the bottom surface. (See also W80-01209) (Steiner-Mass)
W80-01246

ECOLOGICAL EFFECTS OF FISHPOND AMELIORATION,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
S. Hejny, and S. Husak.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 409-415, 1978. 1 Fig.

Descriptors: *Marsh management, *Marsh plants, Wetlands, Freshwater marshes, Vegetation regrowth, Wildlife, Fish management, Farm ponds, Littoral, *Ecological effects.

In modern pond management, amelioration is mainly performed in two ways: (1) the mechanical way, using heavy machinery and (2) the biotechnical way, employing duck- and goose-farming. The heavy machinery technique employs scrapers for removal of the littoral vegetation during winter or summer drainage of a fishpond. This practice results in a change in the character and physiognomy of the fishpond and changes in the bottom soils, mineral nutrients, and hydrological regimes. It frequently creates favorable conditions for the regeneration of macrophyte communities characteristic of meso- to oligotrophic habitats. Ducks and geese ameliorate ponds by feeding on plants and by suppressing the development of certain plant communities by their accumulated excrements. (See also W80-01209) (Steiner-Mass)
W80-01248

BIBLIOGRAPHY OF ENVIRONMENTAL STUDIES ON LAKE CHAMPLAIN,
For primary bibliographic entry see Field 2H.
W80-01581

7. RESOURCES DATA

7B. Data Acquisition

SELECTION OF SAMPLING AREAS IN ASSESSMENT OF PRODUCTION,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok, and J. Kvet.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 163-174, 1978. 3 Fig, 3 Tab.

Descriptors: *Marsh plants, *Productivity, *Sampling, *Measurement, Wetlands, Freshwater marshes, Ponds, Littoral, Standing crop, Biomass, Census, Assay, Estimating, Non-destructive tests, Roots.

Macrophyte production and biomass estimates were made in nearly monospecific stands which frequently occur in the littorals of South Bohemia and South Moravian fishponds. In a monospecific stand, the selection of sampling plots and methods depends on the aim of the investigation. Three different techniques were applied: (1) The biomass was measured in plots with the highest density, selected intentionally within a stand. This technique provides an estimate of the maximum production capacity. (2) The average biomass present in the whole area occupied was estimated by various methods. (3) The seasonal changes in shoot biomass were followed both by direct and indirect methods which provided the basis for growth analysis. All three techniques yielded data on the aerial biomass. The underground biomass was assessed only in some instances. (See also W80-01209) (Steiner-Mass)
W80-01223

A STATISTICAL TECHNIQUE FOR DETERMINING RAINFALL OVER LAND EMPLOYING NIMBUS 6 ESMR MEASUREMENTS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
E. Rodgers, H. Siddalingaiah, A. T. C. Chang, and T. Wilheit.
Journal of Applied Meteorology, Vol 18, No 8, p 978-991, August 1979. 10 Fig, 12 Tab, 32 Ref.

Descriptors: *Rainfall, *Remote sensing, *Satellites(Artificial), *Southeast U.S., Temperature, Microwaves, Data collections, Sampling, Data processing, Statistical methods, Statistical models, Mathematical models, Statistics, Analytical techniques, Meteorology. Nimbus 6, ESMR measurements.

At 37 GHz, the frequency at which the Nimbus 6 Electrically Scanning Microwave Radiometer (ESMR 6) measures upwelling radiance, it has been shown theoretically that the atmospheric scattering and the relative independence on electromagnetic polarization of the radiances emerging from hydrometeors make it possible to monitor remotely active rainfall over land. In order to verify experimentally these theoretical findings and to develop an algorithm to monitor rainfall over land, the digitized ESMR 6 measurements were examined statistically. Horizontally and vertically polarized brightness temperature pairs from ESMR 6 were sampled for areas of rainfall over land as determined from the rain recording stations and the WSR 57 radar and for areas of wet and dry ground (whose thermodynamic temperatures w ere greater than 5 C) over the southeastern United States. These three categories of brightness temperatures were found to be significantly different in the sense that the chances that the mean vectors of any two populations coincided were less than 1 in 100. Since these categories were significantly different, classification algorithms were then developed. Three decision rules were examined: the Fisher linear classifier, the Bayesian quadratic classifier, and a non-parametric linear classifier. The Bayesian algorithm was found to perform best, particularly at a higher confidence level. An independent test case analysis showed that a rainfall area delineated by the Bayesian classifier coincided well with the synoptic-scale rainfall area mapped by ground recording rain data and radar echoes. (Sims-ISWS)
W80-01262

MEASURING HYDRAULIC CONDUCTIVITY IN CLAY SOILS: METHODS, TECHNIQUES, AND ERRORS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia)
D. S. McIntyre, R. B. Cunningham, V. Vatanakul, and G. A. Stewart.
Soil Science, Vol 128, No 3, p 171-183, September 1979. 3 Fig, 8 Tab, 18 Ref.

Descriptors: *Hydraulic conductivity, *Soils,*Clays, *Measurement, *Analytical techniques, Soil properties, Permeameters, Irrigation, Clay loam, Instrumentation, Hydraulic gradient, Pores, Gases, Expansive clays, Soil water movement, Cores, Methods, Swelling soils.

A standard method for determining hydraulic conductivity of packed, fragmented material has been evaluated for clay soils, 15 in all, covering a range of water stability and degree of swelling. The particular method tested is a comparative, or analogue-type, measurement, widely used in irrigation capability studies. The data were presented, along with related soil properties, with the results for three nonclay soils for comparison. The value of divided outflow permeameters for measurement in both soil cores and fragmented material was also investigated; theoretically this method allows correction for wall flow, or for the effects of deformation near the wall when the soil swells. Equivalent hydraulic conductivity values were obtained with constant-head and falling-head techniques, except very early in an experiment. Replacement of air with carbon dioxide in the packed soils, before application of water, reduced variability and made experimentation more tractable. The effect of covering the surface of the soil with sand, a variation

sometimes used to alleviate slaking and dispersion, depended strongly on the nature of the soil and was not recommended. Examination of instrument and measuring errors showed that these could be large, but statistical analysis of the date indicated a relatively low between-sample variability of the measured hydraulic conductivity and other properties of the packed soil. (Visocky-ISWS)
W80-01265

A CLOSE-INTERVAL WATER SAMPLER WITH MINIMAL DISTURBANCE PROPERTIES,
Oslo Univ. (Norway).
I. A. Blakar.
Limnology and Oceanography, Vol 24, No 5, p 983-988, September 1979. 5 Fig, 11 Ref.

Descriptors: *Water sampling, *Equipment, *Data collections, On-site data collections, Water chemistry, Bioassay, Plankton, Sampling, Surveys, Lakes, Limnology, Water samplers.

A simple, pneumatically operated, multilevel sampler, easily constructed of cheap, readily available material, was described. Syringes of different volumes can be attached swiftly and can be interchanged at appropriate intervals. External parts are immovable during filling, thus reducing disruption of microstratifications and keeping contamination of samples to an absolute minimum. The sampler can be used for dissolved gas analyses and multiple bioassay investigations. (Sims-ISWS)
W80-01269

A DEVICE TO HOLD AND IDENTIFY ROCK-FILLED BASKETS FOR BENTHIC SAMPLING IN LARGE RIVERS,
Battelle Pacific Northwest Labs., Richland, WA. Ecosystems Dept.
T. L. Page, and D. A. Neitzel.
Limnology and Oceanography, Vol 24, No 5, p 988-990, September 1979. 3 Fig, 5 Ref.

Descriptors: *Sampling, *Benthos, *Rivers, Equipment, Data collections, On-site investigations, On-site data collections, Rocks, Sediments, Benthic fauna, Benthic flora, Rock-filled baskets.

A holder with rock-filled baskets attached at intervals in specific, easily identifiable locations provides a means of benthic sampling under adverse conditions of current and visibility. Two methods of bagging the rock-filled baskets were described. (Sims-ISWS)
W80-01270

A DURABLE, RESUABLE ENCLOSURE SYSTEM THAT COMPENSATES FOR CHANGING WATER LEVELS,
Indiana Univ. at Bloomington. Dept. of Biology.
D. H. Landers.
Limnology and Oceanography, Vol 24, No 5, p 991-994, September 1979. 2 Fig, 5 Ref.

Descriptors: *Lakes, *On-site investigations, *Equipment, Design, Materials, Water levels, Winds, On-site tests, Testing, Limnology, Enclosure systems.

Low-cost enclosures (2-m diameter) made of UV-resistant, cross-laminated polyolefin sheeting reinforced with a grid of twisted polyester filaments have a depth-compensating capacity from 0.5 to 2.2 m and can be used where water level may fluctuate. Field testing for 126 days showed six such enclosures to be convenient and durable. (Sims-ISWS)
W80-01271

EFFECT OF SURFACE ROUGHNESS ON THE MICROWAVE EMISSION FROM SOILS,
Computer Sciences Corp., Silver Spring, MD.
B. J. Choudhury, T. J. Schmugge, A. Chang, and R. W. Newton.
Journal of Geophysical Research, Vol 84, No C9, p 5699-5706, September 20, 1979. 7 Fig, 3 Tab, 22 Ref.

Descriptors: *Remote sensing, *Microwaves, *Soil moisture, Theoretical analysis, Mathematical models, Model studies, Measurement, On-site investigations, Soil temperature, Soil water, Soils, Soil science, Microwave emission, Roughness effects.

The effect of surface roughness on the brightness temperature of a moist terrain was studied through the modification of Fresnel reflection coefficient and using the radiative transfer equation. The modification involved introduction of a single parameter to characterize the roughness. It was shown that this parameter depends on both the surface height variance and the horizontal scale of the roughness. Model calculations were in good quantitative agreement with the observed dependence of the brightness temperature on the moisture content in the surface layer. Data from truck mounted and airborne radiometers were presented for comparison. The results indicated that the roughness effects are great for wet soils where the difference between smooth and rough surfaces can be as great as 50K. (Sims-ISWS)
W80-01277

THE RESULTS OF TEN YEARS' EXPERIMENTAL STUDY ON PLYNLIMON, MID-WALES, AND THEIR IMPORTANCE FOR THE WATER INDUSTRY,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2A.
W80-01290

7C. Evaluation, Processing and Publication

A SYSTEM FOR REGIONAL ANALYSIS OF WATER AVAILABILITY,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W80-01295

GROUND-WATER AVAILABILITY IN TEXAS, ESTIMATES AND PROJECTIONS THROUGH 2030,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W80-01297

OCCURRENCE, AVAILABILITY, AND CHEMICAL QUALITY OF GROUND WATER IN THE EDWARDS PLATEAU REGION OF TEXAS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W80-01298

RECORDS OF WELLS, CHEMICAL ANALYSES, AND WATER LEVELS OF SELECTED EDWARDS WELLS, BEXAR COUNTY, TEXAS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W80-01299

GEOLOGICAL SURVEY RESEARCH 1977,
Geological Survey, Reston, VA. Water Resources Div.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $6.00.

Descriptors: *Natural resources, *Programs, *Projects, *Water resources, *Geologic investigations, United States, Foreign countries, Mineralogy, Water analysis, Analytical techniques, Land use, Mapping, Data collections, Chemical analysis, Geothermal studies, Oil, Coals, Remote sensing, Satellites(Artificial), Evaluation, *U.S. Geological Survey projects, Cooperating agencies.

This U.S. Geological Survey activities report includes a summary of 1977 fiscal year scientific and economic results accompanied by a list of geologic and hydrologic investigations in progress and a report on the status of topographic mapping. The summary of results includes: (1) Mineral and water resources, (2) Engineering geology and hydrology, (3) Regional geology, (4) Principles and processes, (5) Laboratory and field methods, (6) Topographic surveys and mapping, (7) Management of resources on public lands, (8) Land information and analysis, and (9) Investigations in other countries. Also included are lists of cooperating agencies and Geological Survey offices. (Woodard-USGS)
W80-01416

PROGRAMS AND ACTIVITIES OF THE MISSOURI DISTRICT, WATER RESOURCES DIVISION, U.S. GEOLOGICAL SURVEY, FISCAL YEAR 1979,
Geological Survey, Rolla, MD. Water Resources Div.
W. M. Kratzer.
Geological Survey open-file report 79-1058, July 1979. 57 p, 2 Fig, 4 Tab, 125 Ref.

Descriptors: *Water resources, *Projects, *Programs, *Water quality, *Missouri, Publications, Bibliographies, Data collections, Sites, Hydrologic data, Networks, Gaging stations, Crest-stage gages, Low-flow, Urban runoff, Reviews.

Water-resources investigations of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and conducting interpretive investigations. The data and the results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. This report describes the data-collection activities and investigations in Missouri for the 1979 fiscal year and provides an extensive list of water-resources references for the State. (Woodard-USGS)
W80-01417

WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1978--VOLUME 1. ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY,
Geological Survey, Trenton. NJ. Water Resources Div.
Geological Survey Water-Data Report NJ-78-1, June 1979. 558 p, 14 Fig, 5 Tab, 36 Ref.

Descriptors: *New Jersey, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Atlantic Slope basins(NJ).

Water resources data for the 1978 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the Atlantic Slope basin, Hudson River to Cape may, and contains discharge records for 72 gaging stations; tide summaries for 7 stations; stage and contents for 15 lakes and reservoirs; water quality for 39 gaging stations, 154 partial-record stations, and 185 wells; and water levels for 18 observation wells. Also included are 45 crest-stage partial-record stations and 38 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (Woodard-USGS)
W80-01430

WATER RESOURCES DATA FOR NEVADA, WATER YEAR 1978,
Geological Survey, Carson City, NV. Water Resources Div.
Geological Survey Water-Data Report NV-78-1, June 1979. 368 p, 9 Fig.

Descriptors: *Nevada, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Nevada consist of records of discharge and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 126 gaging stations; stage and contents for 20 lakes and reservoirs; water-quality data for continuing-record stations at 30 stream sites and for partial-record stations at 69 stream sites, 2 lake sites, and 7 wells; and water levels for 185 observation wells. Also included are 109 crest-stage partial-record stations and 13 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Nevada. (Woodard-USGS)
W80-01431

MAP SHOWING PRINCIPAL DRAINAGE BASINS, PRINCIPAL RUNOFF-PRODUCING AREAS, AND SELECTED STREAMFLOW DATA IN THE KAIPAROWITS COAL-BASIN AREA, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. Price.
Available from Branch of Distribution, USGS, Box 25286, Fed. Ctr. Denver CO 80225, price $1.25. Geological Survey Miscellaneous Investigation Series Map I-1022-E, 1978. 1 Sheet, 3 Ref.

Descriptors: *Streamflow, *Runoff, *Precipitation(Atmospheric), *Watersheds(Basins), *Mapping, Perennial streams, Ephemeral streams, Intermittent streams, Snowmelt, Rainfall, Drainage area, Discharge(Water), Flow rates, Utah, *Kaiparowits coal-basin area.

This is one of several maps in the U.S. Geological Survey Miscellaneous Investigations Map Series that describe the geology and related natural resources of the Kaiparowits coal-basin area, Utah. About 96 percent of the area drains to the Colorado River, mostly through the Escalante River and Wahweap, Warm, and Last Chance Creeks. The remaining 4 percent drains to the Great Basin through the Sievier River. The Escalante River and several of its headwater tributaries are perennial streams, but most others in the area are intermittent of ephemeral. Estimated average annual runoff in the area ranges from less than 1 inch in most places to more than 10 inches in the headwater area of the Escalante River. Most of the runoff, which occurs during late spring and early summer, results from melting snow and seasonal rains. Summer cloudburst flooding is common throughout the area. Peak flood flows of more than 3,000 cubic feet per secnod have been recorded from drainage areas of less than 100 square miles, and a peak floodflow of more than 15,000 cubic feet per second has been recorded on the Paria River. (Woodard-USGS)
W80-01438

LAND COVER MAP OF THE GREEN SWAMP AREA, CENTRAL FLORIDA,
Geological Survey, Austin, TX. Water Resources Div.
B. F. McPherson.
Available from Branch of Distribution, USGS, 1200 S. Eads St. Arlington, VA. 22202, price $1.50. Geological Survey Miscellaneous Investigations Series Map I-1134, 1979. 1 Sheet, 3 Fig, 3 Ref.

Descriptors: *Florida, *Marshes, *Swamps, *Land use, Vegetation, Trees, Forests, Range grasses, Citrus fruits, Pastures, Land reclamation, Surface waters, Soil-water-plant relationships, Ecosystems, Mapping, Biological communities, *Green Swamp, *Central Florida, *Land cover map.

The Green Swamp area occupies about 870 square miles of swampy flatlands and sandy ridges in central Florida. Five major drainage systems originate within or near the swamp and flow in several directions to the sea. The land cover and vegetation of the Green Swamp area has been broken into 15 categories: (1) cypress forest, (2) river bottom swamp, (3) mesic hammock forest, (4) mixed swamp forest, (5) pine flatwoods, (6) sandhill uplands, (7) liveoak stands, (8) marshes and wet prairies, (9) rangeland, (10) pasture, (11) upland pasture, (12) citrus groves, (13) stripped land, (14) built-up land, and (15) water bodies. Each category has a color code and is mapped at a scale of 1:63,350 (1 inch to the mile). (Woodard-USGS)
W80-01439

GEOLOGICAL SURVEY RESEARCH 1978,
Geological Survey, Reston, VA. Water Resources Div.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $6.50. Geological Survey Professional Paper 1100, 1978. 464 p, 4 Fig, 4 Tab, 537 Ref

Descriptors: *Natural resources, *Programs, *Projects, *Water resources, *Geologic investigations, United States, Foreign countries, Mineralogy, Water analysis, Analytical techniques, Land use, Mapping, Data collections, Chemical analysis, Geothermal studies, Oil, Coals, Remote sensing, Satellites(Artificial), Evaluation, U.S. Geological Survey projects, Cooperating agencies.

This U.S. Geological Survey activities report includes a summary of 1978 fiscal year scientific and economic results accompanied by a list of geologic and hydrologic investigations in progress and a report on the status of topographic mapping. The summary of results includes: (1) Mineral and water resources, (2) Engineering geology and hydrology, (3) Regional geology, (4) Principles and processes, (5) Laboratory and field methods, (6) Topographic surveys and mapping, (7) Management of resources on public lands, (8) Land information and analysis, and (9) Investigations in other countries. Also included are lists of cooperating agencies and Geological Survey offices. (Woodard-USGS)
W80-01587

NOTES ON SEDIMENTATION ACTIVITIES, CALENDAR YEAR 1977,
Geological Survey, Reston, VA. Water Resources Div.
Geological Survey Office of Water Data Coordination report, April 1979. 442 p, 1 Fig, 2 Tab, Append.

Descriptors: *Sedimentation, *Projects, *Programs, *Publications, *Reviews, Sediment transport, Particle size, Sediment control, Sediment discharge, Sediment distribution, Sediment load, Sediment sorting, Sediment yield, Sedimentation rates, United States, Alaska, Hawaii, Puerto Rico.

This report is a digest of information furnished by Federal agencies conducting sedimentation investigations on work in progress or planned, important findings, new methods, new publications, laboratory and other research activities, and other pertinent information. The material has been organized by major drainage regions in the conterminous United States, Alaska, Hawaii, Puerto Rico, and foreign activities. There is also a section on research and other activities. (Woodard-USGS)
W80-01593

WATER RESOURCES OF THE SWINOMISH INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost.
Geological Survey Water-Resources Investigations 79-12 (open-file report), 1979. 83 p, 20 Fig, 5 Plates, 10 Tab, 16 Ref.

Descriptors: *Water resources, *Evaluation, *Indian reservations, *Water quality, *Hydrologic budget, Washington, Surface waters, Groundwater resources, Available water, Water resources development, Potential water supply, Well data, Water levels, Chemical analysis, Saline water-freshwater interfaces, *Swinomish Indian Reservation(Wash).

Average total inflow to and outflow from the hydrologic system of the Swinomish Indian Reservation, Wash., is 24 cfs (cubic feet per second). Recharge to the ground-water reservoir is 8 cfs. The study area is underlain by three types of unconsolidated deposits: the uppermost unit is till, the intermediate unit is sand and gravel, and the lowermost unit is clay and silt. During 1975 the average rate of water use was 0.19 cfs. About 70 percent was pumped from the ground-water reservoir and the rest was imported. Dissolved-solids concentrations are 10-20 mg/L (milligrams per liter). In the zone of saltwater, differsion concentrations up to 1,570 mg/L were measured. Human interaction with the hydrologic system has had little effect on water quality. Ground-water quality is generally well within acceptable limits for most uses. If 20 percent of ground-water can be intercepted then a net rate of withdrawal of 1.6 cfs can be attained. Aquiculture development is possible on the two largest streams in the reservation in the form of incubation stations handling 600,000 eggs each. (Woodard-USGS)
W80-01599

8. ENGINEERING WORKS

8A. Structures

LARGE-SCALE FREEZING WORK FOR SUBWAY CONSTRUCTION IN JAPAN,
Tokyo Metropolitan Government (Japan).
M. Miyoshi, T. Tsukamoto, and S. Kiriyama.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 397-415, April 1979. 10 Fig, 5 Tab.

Descriptors: *Tunneling, *Frozen soils, *Underground structures, *On-site investigations, Tunnel construction, Freezing, Frozen ground, Foreign countries, Foreign research, Temperature, Measurement, Construction, Equipment, *Japan.

In this freezing work, 4 parallel tunnels are being constructed simultaneously by the freezing method under a river in the central part of Tokyo. Over the proposed tunnels there exists an old concrete arch bridge across the river. In addition, in the river there are piers of an expressway viaduct quite close to the tunnels to be constructed. Under such conditions, this freezing work is being carried on with great care, taking safety measures as described below. (1) Prevention of excessive growth of frozen zone: installation of heating pipes; and partial application of steel pipe wall for earth retaining instead of ground freezing. (2) Minimization of damage caused by expansion of frozen soil: rationalization of freezing procedure to prevent confined freezing; extraction of surplus groundwater by vacuum pumps; and use of stabilizing liquid to reduce frost expansion pressure. (3) Strict watch for frozen soil: installation of instruments for measuring soil temperatures and displacements; and constant observation by a centralized control/watch system. (See also W80-01498) (Humphreys-ISWS)
W80-01526

THE SOIL-FREEZING METHOD FOR LARGE TUNNEL CONSTRUCTIONS,
Holzmann (Phillip) A. G., Frankfurt am Main (Germany, F.R.).
H. Wind.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 417-423, April 1979. 4 Fig.

Descriptors: *Tunneling, *Frozen soils, *Underground structures, Frozen ground, Tunnel construction, Freezing, Construction, Foreign countries, Methodology, *Switzerland, *Finland, *Germany.

A new and important impetus to further development of the soil-freezing method has come from tunnelling works executed in Stuttgart, Aarburg, Helsinki, Frankfurt, Dusseldorf, and Zurich. These examples of the use of the soil-freezing method

applied in large tunnelling projects showed that this construction method can compete well with traditional methods in both technical and economic aspects. This has been made possible by the efforts of participant engineers of various disciplines of the executing firms, by scientists and by understanding clients. It is a motivation for all concerned to continue their cooperation in order to find solutions for the many problems still unsolved in this field. (See also W80-01498) (Humphreys-ISWS)
W80-01527

SUBWAY CONSTRUCTION IN STUTTGART UNDER PROTECTION OF A FROZEN SOIL ROOF,
Holzmann (Phillip) A. G. , Frankfurt am Main (Germany, F. R.).
G-P. Jonuscheit.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 425-428, April 1979.

Descriptors: *Tunneling, *Frozen soils, *Underground structures, Frozen ground, Tunnel construction, Tunnel linings, Freezing, Construction, Marl, Gypsum, Excavation, Methodology, Foreign countries, Gunite, *Germany.

Experiences gained on the building of the City Railway turning loop, Stuttgart, Secion 12, were described, where the new Austrian tunneling method was used in connection with the freezing technique. The Metro-tunnel lies in leached-out gypsum marl and unleached zones, respectively. In a section of this tunnel within the leached-out gypsum marl, the excavation was protected by a frozen soil roof in order to keep away any water seepage which could be dangerous for the evcavation itself and for the buildings superimposed as well. The drilling for freeze pipes, the installation and operation of the freezing system, and the tunnel driving included the erection of the final support were described. A point of special interest was the application of the shot-crete method as the shotcrete has to adhere to the frozen soil and has to harden sufficiently before the hardening process is interrupted by frost penetration. (See also W80-01498) (Humphreys-ISWS)
W80-01528

GROUND FREEZING FOR SUPPORT OF OPEN EXCAVATIONS,
Terrafreeze Corp., Lorton, VA.
For primary bibliographic entry see Field 2G.
W80-01529

8B. Hydraulics

OPEN CHANNEL FLOW WITH VARYING BED ROUGHNESS,
Birmingham Univ. (England).
For primary bibliographic entry see Field 2E.
W80-01280

COST OF CONTROLS FOR 'SMALL HYDRO-ELECTRIC PLANTS' OR RIVER SYSTEMS,
Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
For primary bibliographic entry see Field 6A.
W80-01388

8D. Soil Mechanics

GROUND FREEZING,
For primary bibliographic entry see Field 2C.
W80-01498

FROST HEAVE OF UNSATURATED LOAMY SOIL UNDER FIELD CONDITIONS,
Leningrad Inst. of Constructional Engineers (USSR).
For primary bibliographic entry see Field 2C.
W80-01501

INTERRELATIONSHIP OF THE PRINCIPAL PHYSIOCOMECHANICAL AND THERMO-PHYSICAL PROPERTIES OF COARSE-GRAINED FROZEN SOILS,
Kuybyshevskii Inzhenero-Stroitelnyi Inst. (USSR). Frozen Soil Science and Power Plant Construction Branch Research Lab.
For primary bibliographic entry see Field 2C.
W80-01510

ICE LENS STRUCTURES, COMPRESSION STRENGTHS AND CREEP BEHAVIOR OF SOME SYNTHETIC FROZEN SILTY SOILS,
Continental Oil Co., Ponca City, OK.
For primary bibliographic entry see Field 2C.
W80-01511

CREEP BEHAVIOUR OF FROZEN SOILS IN UNIAXIAL COMPRESSION TESTS,
Karlsruhe Univ. (Germany, F.R.). Inst. of Soil Mechanics and Rock Mechanics.
H. Eckardt.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 185-195, April 1979. 9 Fig, 6 Ref.

Descriptors: *Frozen soils, *Compression strength, *Creep, *Soil strength, Laboratory tests, Strain, Stress, Frozen ground, Loads(Forces), Mechanical properties, Temperature, Analytical techniques, Soil science, Cryogenics.

The stress-strain behavior of frozen soils is often described by means of creep curves from uniaxial or triaxial creep tests. Ten or twelve tests of similar samples are required to obtain a good relationship between stress, strain, temperature, time, or strain rate. To reduce the required number of samples, it is possible to apply the compression load in creep tests stepwise. Therefore, creep curves for different stress levels can be obtained from one sample. In this paper the bearing capacity of cylindrical samples of frozen medium sand under constant uniaxial compression stress and under stepwise increased stresses was compared. It was shown how to use these different creep curves to describe the stress-strain behavior of frozen soils. (See also W80-01498) (Sims-ISWS)
W80-01512

CREEP CHARACTERISTICS OF FROZEN SOILS,
Shimizu Construction Co., Ltd., Tokyo (Japan).
K. Takegawa, A. Nakazawa, K. Ryokai, and S. Akagawa.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 197-205, April 1979. 10 Fig, 3 Tab, 3 Ref.

Descriptors: *Frozen soils, *Creep, *Soil strength, Laboratory tests, Compression strength, Mechanical properties, Frozen ground, Freezing, Theoretical analysis, Temperature, Moisture content, Soils, Soil types, Elastic deformation, Analytical techniques, Soil science, Cryogenics.

Consideration of the creep characteristics of frozen soil is required when it is used for the construction of retaining walls. It is generally accepted that there are three kinds of frozen soils, i.e., frozen soil without ice lenses, frozen soil with layers of ice lenses, and frozen soil with needle-like ice lenses, influenced by freezing conditions and physical properties of the soil itself. This paper was a study of properties of deformation and rheological and strength characteristics of frozen soil with an unconfined compression creep test and an unconfined compression test. The test results showed that existence of alternate ice layers in the frozen soil affects properties of deformation rather than those of strength. Generally, elastic strain appears instantaneously upon loading, and deformation increases with the lapse of time, finally leveling off to a certain value as long as the load is below a limited value. Stress at the time of the greatest of the leveling-off strains is called an upper yield value sigma sub u. It was found that when a stress applied to frozen soil without ice lenses is below the upper yield value mentioned above: (1) strain is linear to time lapse expressed in logarithms; and (2) strain is linear to the stress applied. (See also W80-01498) (Sims-ISWS)
W80-01513

EFFECT OF SPECIMEN SHAPE ON CREEP RESPONSE OF A FROZEN SAND,
Ecole Polytechnique de Montreal (Quebec). Centre d'Ingenierie Nordique.
B. Ladanyi, and J. Arteau.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 207-222, April 1979. 7 Fig, 1 Tab, 25 Ref.

Descriptors: *Frozen soils, *Creep, *Compression strength, *Laboratory tests, Analytical techniques, Frozen ground, Freezing, Sands, Temperature, Strain, Stress, Mechanical properties, Soil strength, Soil science, Cryogenics.

The stress-strain and strength behavior of frozen soils is most often studied in a conventional uniaxial or triaxial compression test. However, available experimental evidence shows that the results obtained in such tests may be considerably affected by the test conditions, i.e., by the specimen shape and the method of axial load transfer to the specimen ends, both of which affect the uniformity of stress and strain distribution in the sample. The methods proposed for solving the problem of load transfer to the specimen ends differ considerably for brittle and ductile materials, respectively. Since a frozen soil may behave either as a brittle or as a ductile material, depending on strain rate, temperature, and confining pressure, it was considered that the load transfer method selected should correspond to the expected sample behavior. In this paper, the results of a series of compression and creep tests were presented, in which the effects of speciment shape and end conditions on the behavior of a frozen sand were systematically investigated and compared. (See also W80-01498) (Sims-ISWS)
W80-01514

STRAIN RATE EFFECT ON THE COMPRESSIVE STRENGTH OF FROZEN SAND,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
T. H. W. Baker.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 223-231, April 1979. 6 Fig, 3 Tab, 13 Ref.

Descriptors: *Frozen soils, *Sands, *Compressive strength, Laboratory tests, Frozen ground, Moisture content, Freezing, Physical properties, Mechanical properties, Loads(Forces), Deformation, Elastic deformation, Strain, Ice, Analytical techniques, *Strain rate.

Cylindrical specimens of fine Ottawa sand (A.S.T.M. designation C-109), compacted at the optimum moisture content and saturated before unidirectional freezing, have been tested in uniaxial compression at a cold room temperature of -5.5 C and strain rates between 0.0000001 and 0.01/s. Variation in the total moisture (ice) content influenced unconfined compressive strength. This was typical of frozen sands slightly oversaturated with ice. Specimens that expanded during freezing showed a reduction in unconfined compressive strength and strain to failure. The four platen types investigated did not significantly affect the value of the unconfined compressive strength or the strain to failure. The mode of failure at the lower strain rates was different for each platen type. Maraset compliant platens produced the most uniform deformation, with no speciment bulging. (See also W80-01498) (Sims-ISWS)
W80-01515

CYCLIC TRIAXIAL TESTS ON FROZEN SAND,

Field 8—ENGINEERING WORKS

Group 8D—Soil Mechanics

Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 2C.
W80-01516

CREEP STRESS ANALYSIS OF FROZEN SOILS UNDER MULTIAXIAL STATES OF STRESS,
Bochum Univ. (Germany, F.R.). Dept. of Civil Engineering.
J. Klein, and H. L. Jessberger.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 353-365, April 1979. 12 Fig, 5 Ref.

Descriptors: *Frozen soils, *Creep, *Laboratory tests, *Analytical techniques, Deformation, Mechanical properties, Stress, Testing procedures, Methodology, Soil mechanics, Finite element analysis, Uniaxial compression tests.

Creep behavior of the so called Emscher-Marl was investigated in uniaxial compression tests under a temperature of -10C. Similar to the results of creep tests published elsewhere, it was shown that the secondary creep controls the deformation. In cases of stationary creep, the material behaves like a nonlinear elasto-viscous Maxwell fluid. Assuming no hydrostatic pressure effect, the power law applied to the uniaxial case can be transformed to multiaxial states of stress. For structures of frozen soil with a long-term deformation process, Norton's power relationship between stress and rate of steady flow leads to reasonable results. As a numerical solution, a finite-element computer program in connection with incremental procedure was developed for treatment of creep problems in ground-freezing technology. The calculation of a simply supported beam demonstrated the important influence of the high nonlinearity in stress and strain for frozen soils. (See also W80-01498) (Humphreys-ISWS)
W80-01523

STRENGTH ANALYSIS OF THE FROZEN-GROUND ENCLOSURE OF A LOW-TERMPERATURE STORAGE RESERVOIR FOR LIQUEFIED GASES,
All-Union Research Inst. for the Utilization of Gas in the Economy and for the Underground Storage of Oil, Oil Products and Liquefied Gases, Moscow, (USSR).
N. P. Ilyina, and Ye. M. Shafarenko.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 367-374, April 1979. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Frozen ground, *Underground storage, *Frozen soils, Mechanical properties, Sands, Youngs modulus, Analysis, Analytical techniques, Laboratory tests, Deformation, Strain, Strength, Bearing strength, Foreign research, Soil mechanics, *USSR, Liquified gases.

The geometrical dimensions of a frozen-ground enclosure for a low-temperature storage reservoir were determined from a static design on the assumption of a safe excavation of ground in digging the trench. Neglecting the combined work of the enclosure and surrounding thawing rock mass, the problem was reduced to the design of the frozen-ground shell, stressed along its outer contour by the thawing ground pressure. To estimate the tension of the wall of an enclosure it was sufficient to use the solution of the problem of a thick-walled tube subjected to ambient pressure. It is difficult to find a sufficiently simple analog for the problem of the bottom. The solution of the plate-bending problem locates the neutral line in the middle of the section when there are equal tensile and compressive stresses at the inner and the outer contour. If the combined work of the bottom of the section and the wall is taken into account, the neutral line shifts from the center of the bottom to the inner contour of the enclosure, i.e., the compressive stresses exceed the tensile ones, which is of particular importance for materials with different resistances to compression and tension. (See also W80-01498) (Humphreys-ISWS)
W80-01524

DESIGN OF TUNNEL SUPPORT SYSTEMS USING GROUND FREEZING,
Law Engineering Testing Co., McLean, VA.
For primary bibliographic entry see Field 2G
W80-01525

GROUND CONSOLIDATION WITH LIQUID NITROGEN (LN2),
Linde A.G., Hollriegelskreuth (Germany, F.R.). Technical Gases Div.
For primary bibliographic entry see Field 2C.
W80-01531

USES AND LIMITATIONS OF GROUND FREEZING WITH LIQUID NITROGEN,
Deilmann-Haniel G.m.b.H., Dortmund (Germany, F.R.).
For primary bibliographic entry see Field 2C.
W80-01532

NATURAL FROST IN IMPROVEMENT OF CONSTRUCTION PROPERTIES OF GROUND IN HYDROENGINEERING AND INDUSTRIAL AND CIVILIAN CONSTRUCTION,
Akademiya Nauk SSSR, Yakutsk. Inst. Merzuotovedeniya.
For primary bibliographic entry see Field 2C.
W80-01533

FROST PROTECTION OF RAILWAY LINES,
Norwegian State Railways, Oslo (Norway)
For primary bibliographic entry see Field 2C.
W80-01534

JOINTING OF TWO TUNNEL SHIELDS USING ARTIFICIAL UNDERGROUND FREEZING,
Seiken Co., Ltd. Osaka (Japan)
For primary bibliographic entry see Field 2G
W80-01535

CONVERSION OF ABANDONED COLLIERIES IN SOUTHERN BELGIUM INTO LOW-PRESSURE GAS STORAGE UNITS. WITH DESCRIPTION OF SPECIAL PLUGGING OF THE VARIOUS SHAFTS,
N. V. Foraky SA., Brussels (Belgium).
For primary bibliographic entry see Field 2G.
W80-01536

APPLICATION OF THE GROUND-FREEZING METHOD TO PENETRATE A SEQUENCE OF WATER-BEARING AND DRY FORMATIONS--THREE CONSTRUCTION CASES,
Thyssen Schachtbau G.m.b.H., Mulheim an der Ruhr (Germany, F.R.).
For primary bibliographic entry see Field 2G.
W80-01537

8I. Fisheries Engineering

EVALUATION OF WATER QUALITY MANAGEMENT PROCEDURES USED ON MISSISSIPPI CATFISH FARMS,
Mississippi State Univ., Mississippi State. Dept. of Agricultural and Biological Engineering.
J. C. McWhorter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80116577, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, October 1979. 31 p 7 Fig, 4 Tab, 11 Ref, Append. OWRT A-122-MISS (1). 14-34-0001-9026.

Descriptors: *Fish farming, *Catfish, *Dissolved oxygen, Aeration, Water quality, Evaluation, Energy, *Humphreys County(MS), Lower Mississippi Delta(MS), Aeration devices.

The purpose of this study was to observe dissolved oxygen in catfish ponds and to relate energy requirements of several aeration systems to dissolved oxygen concentrations. Six ponds in Humphreys County, Mississippi, ranging from 7-30 surface acres, were studied during the months of June, July, and August. Oxygen concentrations were observed daily, in the morning and evening. The BOD and COD were determined on seven occasions at intervals of one to two weeks. Records were kept regarding the operation of 'pump-spray' aerators and lowering the water level and replacing with well water. Morning oxygen levels averaged about 6 mg/l while afternoon average were generally around 9 mg/l. No fish losses were attributed to oxygen deficits; however, some losses occurred as a result of parasites. BOD values ranged from lows of near 3 and 4 to highs of 9 and 10 mg/l. There were several highs in excess of 11 mg/l. COD values ranged from 20 to 100 mg/l. It appeared that each pond tened to retain its BOD and COD characteristics during the study period; however, there was a trend of increasing values as the study period progressed into late August. Some water was added to all ponds and drained from four. The average maximum energy use for one of two ponds using spray aeration was 17 horsepower hours per day per surface acre. Aerated ponds were subjected to more intensive production demands.
W80-01382

EFFECTS OF SOLAR RADIATION ON THE DYNAMICS OF DISSOLVED OXYGEN IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
R. P. Romaire, and C. E. Boyd.
Transactions of the American Fisheries Society, Vol 108, No 5, p 473-478, September 1979. 2 Fig, 4 Tab, 15 Ref. OWRT A-066-ALA (4).

Descriptors: *Dissolved oxygen, *Solar radiation, *Model studies, Mathematical models, Oxygen, Radiation, Effects, Chloropyll, Secchi disks, Algae, Phytoplankton, Fish, Catfish, Channel catfish, Ponds, Aquiculture, Sampling, On-site investigations.

The day time increase in dissolved oxygen (DO) concentration of pond waters may be estimated from solar radiation, chlorophyll a concentration, and percentage 02 saturation at dawn (coefficient of multiple determination, R sq = 0.83), or from solar radiation, Secchi disk visibility, and percentage 02 saturation at dawn (R sq = 0.80). A computer simulation model for predicting the effects of cloudy weather (low solar radiation) on DO depletion was developed for channel catfish ponds. The model incorporates the equation for estimating daytime DO increase from solar radiation and Secchi disk visibility with components for estimating the nighttime decline in DO from respiration by the plankton, fish, and benthic communities, and the gains or losses from diffusion. Results from the study demonstrated that the combination of dense plankton blooms and low levels of light intensity were closedly related to low concentrations of DO. (Sims-ISWS)
W80-01583

9. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

SURVEY OF GAMMA-EMITTING ARTIFICIAL RADIONUCLIDES IN FISH FROM FINNISH WATERS,
Abo Akademi, Turku (Finland). Inst. of Biology.
For primary bibliographic entry see Field 5A
W80-01325

9C. Research Facilities

FOOD INTAKE, GROWTH, FOOD CONVERSION, AND BODY COMPOSITION OF CATFISH EXPOSED TO DIFFERENT SALINITIES.
Bangalore Univ. (India). Dept. of Zoology.

For primary bibliographic entry see Field 5A.
W80-01326

SEDATION OF WARM-WATER FISH SPECIES IN AQUACULTURE RESEARCH,
Stirling Univ. (Scotland) Unit of Aquatic Pathobiology.
For primary bibliographic entry see Field 5A.
W80-01327

THE EFFECTS OF TEMPERATURE ON THE RESPIRATION AND PRODUCTION OF THE FRESHWATER NEMATODE ANONCHUS SP.,
Lancaster Univ., Bailrigg (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-01328

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

BIBLIOGRAPHY OF GEOLOGY AND HYDROLOGY, EASTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
A. F. Wright.
Geological Survey Water-Resources Investigations 79-76, March 1979. 170 p, 1 Fig.

Descriptors: *Bibliographies, *Geology, *Hydrology, *Natural resources, Oil, Natural gas, Potash, Coals, Chemistry, *Eastern New Mexico, *High Plains.

The High Plains of the eastern New Mexico region are recognized as an abundant and varied source of natural resources. The bibliography of over 1,900 references concerned with geology, hydrology, chemistry, and geography has been compiled to assist physical science researchers in their study of this region. (Kosco-USGS)
W80-01591

10D. Specialized Information Center Services

FUNCTIONAL ANALYSIS OF THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER (WRSIC) MISSION,
CENTEC Corp., Reston, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111842, Price codes: A04 in paper copy, A01 in microfiche.

Descriptors: *Documentation, Research, Abstracts, Libraries, Colleges, Universities, *Functional Analysis, Systems Approach, *Water Resources Scientific Information Center.

This document is intended to be used as a framework for communicating present WRSIC capabilities and to guide efforts to identify important new requirements that have arisen due to recent reorganizations and shifts in emphasis affecting WRSIC activities. In particular, the analysis has focused on the relationship of WRSIC to technology transfer and other activities of the Office of Water Research and Technology. Information presented is the result of a modern systems approach that structurally defines the WRSIC mission in terms of detailed functions. Two of the major tools utilized are 'Functional Analysis' and Hierarchy plus Input-Process-Output (HIPO). These tools and their application to the WRSIC mission are described. A graphic overview is presented of the WRSIC information system which was constructed from the HIPO analysis. Following the documentation of the current system, a recommendation for improving the ability of WRSIC to satisfy present and near-future requirements is presented. The plan shows what requirements must be satisfied and suggests a methodology for achievement. Also included is a glossary of organizational and information terms.
W80-01201

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5

BOOKSTACKS
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DEPOSITORY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 5
MARCH 1, 1980

W80-01601--W80-02000
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is printed on the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 5
MARCH 1, 1980

W80-01601--W80-02000

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

URBANIZATION AND STREAM QUALITY IMPAIRMENT,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
For primary bibliographic entry see Field 2B.
W80-01685

COMPARATIVE EVALUATION OF STATISTICAL METHOD FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen, W. J. Rawls, and B. L. Whaley.
Water Resources Bulletin, Vol 15, No 4, p 935-947, August 1979. 1 Fig, 3 Tab, 6 Ref.

Descriptors: *Water supply, *Utah, *Forecasting, *Mathematical models, *Evaluation, Model studies, Regression analysis, Correlation analysis, Runoff, Snowmelt, Watersheds(Basins), Precipitation(Atmospheric), Rainfall, Snowfall, Snowpacks, Streamflow, Water resources, Statistis, Statistical methods, Analytical techniques, *Upper Sevier River(UT).

While the correlation coefficient and standard error of estimate are frequently used when comparing models of seasonal water yield, the following criteria may be more important in selecting one model from among several alternatives: rationality of the regression coefficients, the distribution of the residual errors, and the correctness of indicators of the relative importance of the predictor variables. These criteria were used to compare seasonal water yield models that were calibrated using multiple regression, stepwise regression, principal components, polynomial regression using a principal components rotation, and constrained pattern search. Hydrlogic data from the Upper Sevier River basin in southern Utah were used to illustrate the comparative analysis process. The prediction equations used the April-July streamflow volume as the criterion variable. (Sims-ISWS)
W80-01687

A CRITICAL STUDY OF DESIGN FLOOD FOR SURPLUSING WORKS OF MAJOR, MEDIUM AND MINOR IRRIGATION PROJECTS,
Government of Gujarat, Gandhinagar (India).
For primary bibliographic entry see Field 2E.
W80-01802

WATER RESOURCES IN AGRICULTURE: THE ROLE OF SOIL AND WATER IN AGRICULTURAL PRODUCTION AND ENVIRONMENTAL PROTECTION,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
E. T. Engman.
In: Water for Survival, Volume I: Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC, p 266-275, 1979. 4 Fig, 6 Ref.

Descriptors: *Agricultural watersheds, *Model studies, *Hydrology, Demonstration watersheds, On-site investigations, Water balance, Research and development, Agriculture, Water resources, Hydrologic aspects, Water quality, Research programs.

The Agricultural Research Service (ARS) of the United States Department of Agriculture has a unique research program for studying water resources in agriculture. This program is based on a modeling concept that describes the soil and water interactions in complex agricultural watersheds. Currently, research is conducted in 17 major land resource areas and includes measurements of precipitation and runoff on nearly 300 research watersheds. Most field installations include multiple nested watersheds that represent a range of area sizes and topographies. The types of studies made in these areas include routine data collection, controlled experiments of specific processes, various sampling experiments to define model parameters, and applications of remote sensing to define watershed characteristics and model parameters. Recently, with the emphasis on preserving environmental quality, many areas have also been instrumented to conduct mass balances of chemicals, like fertilizers and pesticides. The modeling approach enables ARS to achieve its objectives with a minimum number of empirical studies. This approach may also be equally applicable to a wider range of conditions throughout the world. (Humphreys-ISWS)
W80-01804

CONSIDERATIONS ABOUT THE CLIMATE AND HYDROLOGICAL REGIME IN SOUTHERN AND SOUTHEASTERN BRAZIL,
Parana Univ. (Brazil). Centro de Hidraulica e Hidrologia.
R. H. Andrzejewski.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC., p 314-324, 1979. 5 Fig, 14 Ref.

Descriptors: *Watersheds(Basins), *Climatology, *Hydrologic aspects, *Hydrographs, Seasonal, Streamflow, Data collections, Meteorology, Hydraulic cycle, Hydrologic data, Climates, Precipitation(Atmospheric), Droughts, Floods, Foreign research, *Brazil.

The hydrological and meteorological mechanisms responsible for precipitation and river discharge patterns in Southern and Southeastern Brazil were briefly described. Some characteristics of these mechanisms were used to discuss the spatial correlation between monthly discharges from several basins in southern and Southeastern Brazil. Variation in climate and hydrological regime was discussed both from a mathematical and from a physical point of view. The annual average hydrographs of the study regions were presented. The ones based on the southern streamflow and rainfall data have a little variability all along the year, and the ones based on the Southeastern data show the seasonal hydrological features of this region, with floods in the summer and droughts during the winter. The difference between seasonal aspects of the discharge of the two regions indicates that there must be a certain degree of independence between the hydrological features of these two regions. (Humphreys-ISWS)
W80-01806

SUBSURFACE DRAINAGE FLOWS UNDER NATURAL RAINFALL CONDITIONS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2F.
W80-01807

A SHORT-TERM FLOOD FORECASTING MODEL BASED ON RETENTION HYSTERESIS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01820

ESTIMATION OF WATER BALANCE OF MAHANADI CATCHMENT UPTO HIRAKUD DAM SITE (1962-1966) BY THORNTHWAITE'S TECHNIQUE,
Meteorological Office, New Delhi (India).
S. D. S. Abbi, K. K. Srivastava, and A. K. Malhotra.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 4, p 717-724, October 1978. 6 Fig, 2 Tab, 4 Ref, 1 Append.

Descriptors: *Water balance, *Watersheds(Basins), *Rivers, Runoff, Precipitation(Atmospheric), Rainfall, Monsoons, Soil moisture, Evaporation, Evapotranspiration, Storage, Water storage, Recharge, Hydrology, *India.

A presentation of water balance of Mahanadi catchment up to Hirakud dam site by Thornthwaite's method was made. For this purpose, values for the monthly water deficit, water surplus, soil moisture utilization, and soil moisture recharge for the years from 1962 to 1966 were tabulated and presented graphically. (Sims-ISWS)
W80-01828

GROUNDWATER EXPLORATION AND DEVELOPMENT TECHNIQUES,
Portland Water Bureau, OR.
For primary bibliographic entry see Field 2F.
W80-01836

FLOOD FLOW FREQUENCY BY SCS-TR-20 COMPUTER PROGRAM,
Gilbert/Commonwealth, Jackson, MI. Environmental System Div.
For primary bibliographic entry see Field 2E.
W80-01876

NONPOINT SOURCE POLLUTION CONTROL BY SOIL AND WATER CONSERVATION PRACTICES,
Cornell Univ., Itahca, NY. Dept. of Agriculture Engineering.
For primary bibliographic entry see Field 2E.
W80-01892

2B. Precipitation

URBANIZATION AND STREAM QUALITY IMPAIRMENT,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
R. D. Klein.
Water Resources Bulletin, Vol 15, No 4, p 948-963, August 1979.

Descriptors: *Urbanization, *Water quality, *Steams, Runoff, Erosion, Floods, Pollutants, Construction, Channel morphology, Temperature, Water temperature, Groundwater, Nutrients, Toxins, Fish, On-site investigations, Sampling, Data processing, *Impervious surfacings, Water quality impairment.

A study was conducted in the Piedmont province of Maryland to determine if a relationship exists between stream quality and the extent of watershed urbanization. During the first phase of the study, 27 small watersheds, having similar characteristics but varied according to land use, were investigated. Using these controlled conditions and eliminating as many interferences as possible, this first phase was intended to determine if a definite relationship did exist between the two factors. Finding that the first phase was successful, the second was initiated which consisted of a comparison of biological sampling data, from other studies, with degree of watershed urbanization. The purpose of this second phase was to ascertain if the relationship between degrees of urbanization and decline in steam quality was linear as watershed area increased and in streams spread throughout the Maryland Piedmont. The principal finding of this study was that stream quality impairment is first evidenced when watershed imperviousness reaches 12%, but impairmanent does not become severe until imperviousness reaches 30%. (Sims-ISWS)
W80-01685

COMPARATIVE EVALUATION OF STATISTICAL METHOD FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-01687

SEVERE FLOODS IN KATHIAWAR AND KUTCH CAUSED BY A MID-TROPOSPHERIC DISTURBANCE,
Observatory, New Delhi (India).

Group 2B—Precipitation

C. Ramaswamy, and V. S. Rao.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 4, p 725-730, October 1978. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Flood, *Rainfall, *Precipitation excess, *Meteorology, Weather, Precipitation(Atmospheric), Precipitation intensity, Circulation, Air circulation, Pressure, Atmospheric pressure, Cyclones, Data processing, *India, *Kutch(India), *Kathiawas(India).

This paper contained a description of a quasi-stationary cyclonic disturbance in July 1935 which persisted for about 18 days in the mid-troposphere and caused intermittent, very heavy rainfall leading to severe floods in Kathiawar and Kutch. The importance of this fact-finding study from the point of view of the Monsoon Experiment 1979 was pointed out. (Sims-ISWS)
W80-01826

A STUDY OF WET SPELLS AND PERSISTENCE OF RAINY DAYS IN RAICHUR,
Agricultural Engineering Inst., Raichur (India).
N. Manohar, and B. N. K. Setty.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 4, p 737-740, October 1978. 1 Fig, 3 Tab, 7 Ref.

Descriptors: *Rainfall, *Time series analysis, *Climatology, Climatic data, Data processing, Frequency, Probability, Rain, Statistics, Statistical methods, Persistence, Meteorology, *India.

The rainfall data for 59 years (1917-1975) of Raichur were analyzed to study the wet spells monthwise by applying logarithmic series to find the distribution pattern of rainfall. The frequency of wet spells was estimated for each month from April to December and were in close agreement with observed frequencies. The probabilities of persistence of rainfall on the (r + s)st day, if the rain had occurred on the preceding r days, were also calculated. (Sims-ISWS)
W80-01827

ESTIMATION OF WATER BALANCE OF MAHANADI CATCHMENT UPTO HIRAKUD DAM SITE (1962-1966) BY THORNTHWAITE'S TECHNIQUE,
Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 2A.
W80-01828

FACE RAINFALL RESULT: SEEDING EFFECT OR NATURAL VARIABILITY,
National Oceanic and Atmospheric Administration, Boulder, CO. Atmospheric Physics and Chemistry Lab.
E. C. Nickerson.
Journal of Applied Meteorology, Vol 18, No 9, p 1097-1105, September 1979. 14 Fig, 5 Tab, 11 Ref.

Descriptors: *Weather modification, *Cloud seeding, *Florida, Rainfall, Precipitation(Atmospheric), Data processing, Variability, Silver iodide, Distribution patterns, Statistics, Statistical methods, Meteorology, Cloud physics, Natural variability, Rainfall variability.

An examination of hourly rainfall within areas designated small outside (SO) and large ouside (LO) revealed that prior to the introduction of a new seeding device (NEI) in 1975, average peninsular rainfall on seed (S) days ouside the Florida Area Cumulus Experiment (FACE) target area was slightly less than rainfall on no-seed (NS) days. However, during the NEI period, average station rainfall within the SO area yielded S/NS ratios as high as 3 for the 6 h period following the release of the first flare. Moreover, during the 3 h period to the time of the first seed, average SO station rainfall on seed days exceeded the rainfall on no-seed days by approximately 60%. The large S/NS ratios that occurred outside the FACE target area during the NEI period were not associated with anomalously high rainfall on seed days, but rather with anomalously low rainfall on no-seed days. For the SO area, differences between seed and no-seed samples are highly significant, with one-tailed P values as low as 0.001 as determined from a Wilcoxon (Mann-Whitney) test. Natural variability, therefore, appears to account for statistically significant difference between areawide rainfall on seed and no-seed days. (Sims-ISWS)
W80-01888

RELATION BETWEEN WEST COASTAL RAINFALL AND NIMBUS 6 SCAMS LIQUID WATER DATA OVER THE NORTHEASTERN PACIFIC OCEAN,
Stanford Research Inst., Menlo Park, CA.
For primary bibliographic entry see Field 7B.
W80-01889

COMMENTS OF THE CLIMAX AND WOLF CREEK PASS CLOUD SEEDING EXPERIMENTS,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
P. V. Hobbs, and A. L. Rango.
Journal of Applied Meteorology, Vol 18, No 9, p 1233-1237, September 1979. 3 Fig, 13 Ref.

Descriptors: *Weather modification, *Cloud seeding, *Rocky Mountain Region, *Colorado, Weather data, Data processing, Temperature, Air temperature, Silver iodide, Clouds, Cloud physics, Precipitation(Atmospheric), Snow, Snowfall, Meteorology.

The physical hypotheses for the cloud seeding experiments carried out by Colorado State University in the Colorado Rockies (Climax I and II Wolf Creek Pass) in the 1960's were critically examined. Ariborne measurements over the Rockies have shown that the concentrations of ice particles in the natural clouds are often much greater than originally assumed; consequently, the conditions under which it might be possible to increase precipitation by artificial seeding are probably much more limited than previously supposed. There appears to be no firm evidence to support the contention that 500 mb temperatures are a good measure of cloud-top temperatures over the Rockies. Finally, examination of a moreextensive data set than previously used failed to substantiate eht claim that precipitation over the Rickies decreases as 500 mb temperatures increase above certain values. (Sims-ISWS)
W80-01891

SOME ASPECTS OF THE RELATION BETWEEN MONTHLY TEMPERATURES AND RAINFALL, AND ITS USE IN EVALUATING EARLIER CLIMATES IN THE MIDDLE EAST,
Israel Atomic Energy Commission, Tel-Aviv.
H. L. Striem.
Climatic Change, Vol 2, No 1, p 69-74, 1979. 2 Tab, 2 Fig, 8 Ref.

Descriptors: *Rainfall disposition, *Meteorology, *Correlation analysis, *Hydrologic cycle, *Temperature, *Paleoclimatology, Probable maximum precipitation, Atmospheric precipitation, History, Weather data, Israel.

In the present era, rainfall in the Middle East is associated with the passage of depressions and cold fronts. Using the mean monthly temperature and precipitations at Jerusalem during the hundred years 1861-1960 as published in the World Weather Record (1966) as source material, the author has calculated the average for the whole period and for subperiods to demonstrate that (1) the long-term (100 years) mean monthly precipitations are negatively and, to a first approximation, linearly correlated with temperatures, implying a 13.1 mm increase in monthly precipitation for a decrease of 1 degree C in temperature at Jerusalem, and (2) the inter-annual variations of 30 year subperiods, even with the small changes in temperature and precipitations involved, also show the same basic trend, especially during the coldest and rainiest month of January and February. It is suggestd that this coefficient can be applied, with some qualifications, to the study of rainfall in earlier periods in the Middle East. (Tickes-Arizona)
W80-01950

2C. Snow, Ice, and Frost

COMPARATIVE EVALUATION OF STATISTICAL METHOD FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-01687

2D. Evaporation and Transpiration

PERFORMANCE OF A F.R.P. PAN EVAPORIMETER,
Meteorological Office, Poona (India).
T. R. Rao, and K. S. Rao.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 4, p 701-704, October 1978. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Evaporators, *Evaporation, *Evaporation pans, Energy, Corrosion, Advection, Thermal properties, Copper, Winds, Thermal conductivity, *India, *Fibreglass reinforced plastic pan, Sunken pans, Thermal energy, Shallow lake evaporation, Energy balance, Tank material.

There was no agreement between the performance of a fibreglass reinforced plastic pan and a standard U.S.A., class A pan. Measurements were taken for 14 months on identically exposed and dimensioned pans at the Central Agrimet. Observatory, Pune, India. Differences in their behavior were explained in terms of the thermal properties of the pan. By virtue of the lack of heat exchange with the environment above ground as in the case of a standard class A pan, and by the absence of advection interactions in ground as in the case of a sunken GGI-3000 pan, the fibreglass pan fared better in approaching values of evaporation from a giant sunken 20 sq m tank of 2 m depth. The greatest differences were from 1430 to 1730 IST, and differences were small from 0830 to 1430 IST. (Roberts-ISWS)
W80-01829

SPACE-CORRELATION FIELDS OF PAN EVAPORIMETER NETWORK,
Meteorological Office, Poona (India).
T. R. Rao.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 24, No 4, p 681-685, October 1978. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Evaporimeters, *Networks, *Evaporation, Hydrologic cycle, Water management, Crop production, Crops, Evaporation pans, *India, *Space-correlation fields, *Pan evaporation network, Inter-station correlation, World meteorological organization.

The field of inter-station correlations of pan evaporimeter network of India has been analyzed by seasons. The scale of evaporation phenomenon during various seasons was pointed out in the light of this analysis. Regions where further strengthening of the network density was required were indicated. Correlation-distance relationships were found to be poor in all seasons south of 15 deg N latitude and over a lesser extent throughout the country during periods other than winter. The scale of evaporation field was high in winter when compared to other seasons. It was homogeneous over north and central parts of the country but became less homogeneous towards the south. (Roberts-ISWS)
W80-01831

DEVELOPMENT AND INSTALLATION OF A SIMPLE MECHANICAL WEIGHING TYPE LYSIMETER,
Central Soil and Water Conservation Research and Training Inst., Dehra Dun (India).
S. P. Bhardwaj, and G. Sastry.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 797-802, July-August 1979. 10 Fig, 13 Ref.

Descriptors: *Lysimeters, *Weight, *Evapotranspiration, Crops, Retaining walls, Runoff, Soil moisture, Water seepage, Hydrologic budget, Crop production, *Weighing type lysimeter, *Reinforced concrete structure, Lysimeter tank, Weighing bridge, Soil monolith, Retaining tank.

A simple weighing type lysimeter model fabricated from easily available and indigenous materials was developed. The main components of the assembly were a reinforced concrete structure, dormant platform weigher, lysimeter tank, and retaining tank. The lysimeter tank (120 cm cube) contained an undisturbed soil monolith, had provision for measuring runoff and seepage losses, and was supported by a weighing bridge with a sensitivity of 200 g (0.14 mm of water). The system was quite suitable for water budgeting and evapotranspiration studies on an hourly or daily basis even in remote areas. (Roberts-ISWS)
W80-01890

2E. Streamflow and Runoff

COMPARATIVE EVALUATION OF STATISTICAL METHOD FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-01687

FLOODWAY DETERMINATION COMPUTER PROGRAM.
Soil Conservation Service, Washington, DC. Engineering Div.
Technical Release 64, June 1978. 10 p, 4 Ref, 4 Exhibits.

Descriptors: *Floodways, *Flood profiles, *Computer programs, *Channels, Water conveyance, Open channels, Flood discharge, Rivers, Channel flow, Hydraulics, Data processing, Programs, Flood stages, Water levels.

The Floodway Determination (FLDWY) computer program is used to determine the floodway for flood hazard and flood insurance studies. It is a revision of and replacement for previous HUD-15 programs. A floodway is defined as the minimum width at a cross section that is required to carry the selected (generally 100-year) flood with a specified increase in the water surface elevation. The procedure in the program is based on the equal conveyance reduction concept. No encroachment or narrowing of the channel is allowed. For multiple channels, any overbank segment between channel segments is considered part of the channel. This program does not compute floodways at road sections. An example of an application of the computer programs was presented. (Humphreys-ISWS)
W80-01710

COMPLEX SIMULTANEOUS ANALYSIS OF THE SAVA RIVER AT DIFFERENT HYDROLOGICAL CONDITIONS,
Hydrometeorological Inst. of Croatia, Zagreb (Yugoslavia).
For primary bibliographic entry see Field 5C.
W80-01756

DIET OF BROOK TROUT (SALVELINUS FINTINALIS MITCHELL) AND BROWN TROUT (SALMO TRUTTA L.) IN AN ALPINE STREAM,
Maryland Univ., College Park, Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W80-01770

FLOODPLAIN SERVICES AVAILABLE FROM THE ILLINOIS STATE WATER SURVEY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 10D.
W80-01800

DETERMINISTIC ANALYSIS OF MEXICAN DROUGHTS,
Instituto Technologico y de Estudios Superiores de Occidente, Guadalajara (Mexico), Div. of Civil Engineers.
P. Krausneker.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC., p 97-103, 1979. 2 Fig, 1 Tab, 13 Ref.

Descriptors: *Droughts, *Low flow, *Natural streams, *Watersheds(Basins), Recession curves, Analytical techniques, Analysis, Discharge(Water), Mathematical models, Areal, Foreign research, *Mexico, Un-gaged basins.

Defining drought as low streamflow in natural channels, its deterministic aspect was analyzed by exponential recession curves. Based on daily discharge records of 24 stations in the western central region of Mexico, there were found the specific coefficients for these stations. The coefficients were correlated to the basin areas, thus obtaining a regression formula of the logarithmic type. This formula can help to generate low flow data in order to predict droughts in non-gaged basins. Applications of regression curves on water resources management and the limitations of the deterministic method were mentioned. (Humphreys-ISWS)
W80-01801

A CRITICAL STUDY OF DESIGN FLOOD FOR SURPLUSING WORKS OF MAJOR, MEDIUM AND MINOR IRRIGATION PROJECTS,
Government of Gujarat, Gandhinagar (India).
A. V. Vora.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC., p 185-197, 1979. 4 Fig, 2 Ref.

Descriptors: *Water resources development, *Design flood, *Design criteria, *Floods, Dams, Irrigation, Discharge(Water), Maximum probable flood, Weirs, Peak discharge, Runoff coefficient, Design, Foreign research, *India.

A critical review of the present practice of adopting design flood for major, medium, and minor irrigation projects in Gujarat State, India, was made. By comparing observed floods with design floods, it was pointed out that the design floods have been exceeded 1.5 to 2.7 times, even in the recent past. With the present design, the average cost of head works of major projects is about 60% of total project cost, while the cost for medium projects is about 76%. It was also brought out that only 35% of installed storage capacity is filled for 67% of time for medium projects. It was recommended that the spillways of major and medium projects be designed for 75% maximum probable flood, only. The remaining 25% maximum probable flood may be passed by providing a breaching section. In two cases studied, the cost of breaching section was found to be about 3% of cost of additional spillway. For minor irrigation projects, overdesigning the capacity and taking a calculated risk in areas of poor foundation, as against a completely safe spillway, were recommended as acceptable alternatives. (Humphreys-ISWS)
W80-01802

STEADY SUPERCRITICAL FLOW DOWN AN INCLINED PLANE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 8B.
W80-01812

AN EXPERIMENTAL STUDY OF HYDRAULIC AND GEOMORPHIC CHANGES IN AN ALLUVIAL CHANNEL INDUCED BY FAILURE OF A DAM,
Colorado State Univ., Fort Collins. Engineering Research Center.
Y. H. Chen, and D. B. Simons.
Water Resources Research, Vol 15, No 5, p 1183-1188, October 1979. 8 Fig, 14 Ref.

Descriptors: *Alluvial channels, *Laboratory tests, *Dam failure, *Geomorphology, Hydraulics, Hydraulic models, Model studies, Sediment transport, Flood stages, Open channel flow, Roughness(Hydraulic).

Dam structures may fail to cause significant changes in the downstream river hydraulics and geomorphology. In this study, basic hydraulic and geomorphic principles were utilized to analyze experimental data to assess changes in flood stage, resistance to flow, and transport of deposited sediment following failure of a dam. Experiments were conducted in a flume with a sand clay bed and a gravel bed. The flume was 8-ft long, 0.4-ft wide, and 0.4-ft high. The thickness of the bed layer was 0.1 ft. In the sand clay bed, the bed layer was cut to form a rectangular channel with a channel width of 0.17 ft and with a sinuosity between 1 and 1.53. There was no sediment deposited behind the dam. The channel slope was approximately equal to 0.0025. Another experiment utilized a gravel bed flume to investigate the effects of transport of sediment deposited behind the dam on the river hydraulics and geomorphology. A relation for determining the induced maximum flood stage considering the river sinuosity was presented. It was found that the river sinuosity increases the river resistance to flow and thus increases flood stage. The presence of the sediment deposited behind the dam can significantly reduce resistance to flow and can affect the river hydraulics after the dam failure. Further studies are required to improve our understanding the interaction between the water and sediment transport and the river stability. (Humphreys-ISWS)
W80-01816

A SHORT-TERM FLOOD FORECASTING MODEL BASED ON RETENTION HYSTERESIS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
M. S. K. Chowdhury, F. C. Bell, and J. R. Learmonth.
Water Resources Research, Vol 15, No 5, p 1121-1129, October 1979. 9 Fig, 20 Ref.

Descriptors: *Flood forecasting, *Retention, *Hysteresis, *Soil water, *Model studies, Mathematical models, Groundwater, Wetting, Drying, Storage, Evapotranspiration, Rainfall, Drainage, Streamflow, Runoff, Watersheds(Basins), Floods.

A mathematical model was developed for the continuous prediction of streamflow from catchment rainfall and evaporation data. It realistically simulates the complex hysteretic interactions controlling the catchment moisture status during wetting and drying phases and satisfactorily allows for the effects of discontinuous and multilayered spatial distributions of soil moisture at any given time. Another important feature of this model is its ability to use the current observed discharge as a state variable, and hence it can be tuned during the operational flood forecasting for better predictions. Although relatively simple components have been adopted for channel flow and other runoff time-distributing aspects, the predicted hydrographs generally agreed well with the recorded hydrographs, particularly for moderate and large floods. (Sims-ISWS)
W80-01820

EXTENSION OF ANNUAL STREAMFLOW RECORD BY CORRELATION WITH PRECIPITATION SUBJECT TO HETEROGENEOUS ERRORS,
Institute of Hydrology, Wallingford (England).
R. T. Clarke.
Water Resources Research, Vol 15, No 5, p 1081-1088, October 1979. 3 Tab, 6 Ref, 1 Append.

Descriptors: *Streamflow, *Precipitation(Atmospheric), *Model studies, *Mathematical models, Rainfall, Rain gages, Networks, Streams, Rivers, Drainage, Flow, Annual, Statistics, Statistical models, Analytical techniques.

Mean annual streamflow, mu sub Y, from a basin must frequently be estimated from short streamflow records. Where longer precipitation records are available, regression methods are commonly used to 'extend' the record of annual streamflow with the objective of improving the precision of the estimate of mu sub Y. However, the longer record of annual precipitation consists of mean areal estimates derived from a network of gages, and each year's estimate will be subject to a within-year sampling error with a variance that is a function of the density of the rain gage network used in calculating it. This paper examined the consequences of neglecting to take account of heterogeneous variance of mean areal precipitation where regression of annual streamflow on annual precipitation is used to improve the precision of the estimate of mu sub Y. (Sims-ISWS)
W80-01823

A NONPARAMETRIC MARKOV MODEL FOR DAILY RIVER FLOW,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
S. J. Yakowitz.
Water Resources Research, Vol 15, No 5, p 1035-1043, October 1979. 3 Fig, 2 Tab, 56 Ref. NSF ENG 76-20280, ENG74-20462, GK35915, GF38183.

Descriptors: *River flow, *Mathematical models, *Model studies, *Markov processes, Flow, Daily, Statistics, Statistical analysis, Analytical techniques, Mathematics, Hydrology, *Cheyenne River(SD).

This paper presented to an audience of research hydrologists what is believed to be a significant new development in time series modeling. The model class is the class of (not necessarily finite state) Markov chains. The basic advantage of this class is that in comparison to parametric models (such as autoregressive moving average) it is a very rich class, and the value of the statistical method described is that, as proven elsewhere, it provides convergence over this large class. The technique was applied to Cheyenne River data, and discussion was provided on how to incorporate prior statistical and geological information into the model. Also, comparisons were made between the nonparametric Markov analysis provided here and the currently popular streamflow models and statistical techniques. (Sims-ISWS)
W80-01825

ANALYTICAL PREDICTION OF NATURAL TEMPERATURES IN RIVERS,
Wyoming Univ., Laramie. Dept. of Mineral Engineering.
For primary bibliographic entry see Field 5B.
W80-01856

FLOOD FLOW FREQUENCY BY SCS-TR-20 COMPUTER PROGRAM,
Gilbert/Commonwealth, Jackson, MI. Environmental System Div.
V. Danushkodi.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No Hy9, Proceedings Paper 14818, p 1123-1135, September 1979. 8 Fig, 4 Tab, 10 Ref.

Descriptors: *Flood frequency, *Frequency analysis, *Computer programs, *Michigan, Floods, Hydrology, Rainfall-runoff relationships, Statistical methods, Watersheds(Basins), Flow, Computers, *Flood insurance studies, Log-Pearson type III analysis.

The Soil Conservation Service Computer Program for Project Formulation--Hydrology reproduces the highest recorded flood hydrograph and estimates statistically reliable flood flows for the North Branch Kawkawlin River in Michigan. The Kawkawlin River consists of two major tributaries with entirely different watershed characteristics. The input data required for this program were collected from topographic maps and field visits. Log-Pearson Type III analysis of the recorded annual peak flows showed that the results of this model compare very well and appear to be entirely within the 90% confidence interval. Variability of the skew coefficient affected by a low outlier was shown. Flows at the gaging station are attenuated by a wide floodplain and do not represent flows at other locations. (Lee-ISWS)
W80-01876

HYDRAULIC GEOMETRY OF ACTIVE GRAVEL RIVERS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
G. Parker.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14841, p 1185-1201, September 1979. 9 Fig, 25 Ref, 2 Append.

Descriptors: *River beds, *Open channels, *Channel morphology, *Bed load, Rivers, Hydraulics, Sediment transport, Analysis, Gradation, *Hydraulic geometry, *Stable channels, Gravel channels, Regime theory, Channel characteristics, Mean annual flow, Size distribution.

The hydraulic geometry of straight reaches of wide, active rivers with beds and banks composed of loose gravel is considered. Naive mechanistic formulations lead to the stable channel paradox; stable width is incompatible with an active bed. A resolution of the paradox based on bed stress redistribution due to turbulent lateral transfer of downstream momentum is outlined and is used to obtain three rationally derived regime relations. These dimensionless relations provide channel properties as functions of bed pavement size and two specified variables; e.g., water and sediment discharge, or water discharge and width. Reduction to relations for hydraulic geometry is shown to require information concerning watershed mechanics that is external to the river, and thus fluvially indeterminate. An empirical relation is determined for this purpose, allowing for derivation of dimensionless relations for hydraulic geometry. (Adams-ISWS)
W80-01878

SHEAR-STRESS DISTRIBUTION IN STABLE CHANNEL BENDS,
Calgary Univ. (Alberta). Dept. of Civil Engineering.
M. A. Nouh, and R. D. Townsend.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY10, Proceedings Paper 14898, p 1233-1245, October 1979. 6 Fig, 8 Ref, 2 Apend.

Descriptors: *Shear stress, *Channels, *Model studies, *Boundary layers, Circulation, Topography, Velocity distribution, Open channel flow, Hydraulics, *Bends(Hydraulic), Bed forms, Boundary shear, Stable channel bends.

A theoretical and experimental investigation was made concerning the relationships between secondary flow phenomena in alluvial channel bends and boundary shear-stress distribution and related stable bed topography generated in the vicinity of same. The physical model, a wide rectangular channel system in which two-dimensional flow conditions were reproduced, incorporated an adjustable bend test section, and bends having central angles of 45 deg, 60 deg, 70 deg were adopted in the study. Particular emphasis was placed on an examination of the secondary circulation decay process along that portion of the straight channel reach immediately following the bend section. Observed stable bed topography within the bend and along the downstream decay zone related favorably to the steady-state boundary shear-stress distributions obtained from a numerical model of the flow field therein. (Lee-ISWS)
W80-01880

GRAVEL SIZE ANALYSIS FROM PHOTOGRAPHS,
Cornell Univ., Ithaca, NY. Dept. of Geological Science.
J. Adams.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY10, Proceedings Paper 14908, p 1247-1255, October 1979. 3 Fig, 10 Ref, 2 Append.

Descriptors: *Sediments, *Streams, *Photography, Statistics, Statistical methods, Hydraulics, Gravels, Beaches, Rivers, Particle size, On-site tests.

Gravel sizes measured from photographs of river beds are biased estimates of size when compared to standard sieve analysis. Mean apparent short axis size (for gravel coarser than 8 mm) from photographs may be converted to sieve equivalent mean size by subtracting 0.1 phi (if mean size in phi units) or multiplying by 1.07 (if mean size in mm). Percentile of the distribution also differ by the same factors. Measures of grain size standard deviation from photographs are approximately equivalent to sieve values. For sizes in phi units the photograph and sieve size frequency distribution curves have similar shape but are offset by the same bias as the mean size. (Lee-ISWS)
W80-01881

NONPOINT SOURCE POLLUTION CONTROL BY SOIL AND WATER CONSERVATION PRACTICES,
Cornell Univ., Itahca, NY. Dept. of Agriculture Engineering.
M. F. Walter, T. S. Steenhuis, and D. A. Haith.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 834-840, July-August 1979. 1 Fig, 6 Tab, 40 Ref.

Descriptors: *Pollution abatement, *Pollutants, *Water conservation, *Soil conservatin, Management, Runoff, Conductivity, Moisture, Conservation, Storage, *Nonpoint pollution, *Pollution control, Conservation practices, Soil adsorption properties, Management practices, Surface storage.

There has been a tendency to equate best management practices, as defined in water quality legislation, with soil and water conservation practices. The effectiveness of soil and water conservation practices at controlling potential pollutants other than sediments depends on the characteristics of pollutants. Pollutants were categorized in groups having distinctly different soil adsorption properties which were related to the effect of soil and water conservation practices on water and soil movement. The effects of all the management practices on loss of pollutants were summarized in table form. The purpose behind categorization of pollutants was to allow a logical means of determining which, if any, management practices would effectively control a given pollutants. Problems occurred with this categorization when chemicals changed their absorption behavior as they degraded or were transformed. (Roberts-ISWS)
W80-01892

THE DILEMMA OF STREAM CLASSIFICATION,
Colorado Univ., Boulder.
R. W. Pennak.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 59-66, 1978. 12 Ref.

Descriptors: *Systematics, *Aquatic habitats, *Lotic environment, *Streams, Brooks, Springs, Rivers, Irrigation ditches, Waste water, Silting, Stream fisheries.

Seven distinctive lotic categories may be designated for the USA: springbrooks, tundra brooks, mountain trout streams, sandy streams, and rivers of the Great Plains, medium to large silted rivers, sewage pollution stretches, and irrigation ditches. Each category includes lotic habitats that are remarkably similar from one part of the country to another. All of the many other kinds of lotic habitats of stretches are grouped together as indistinctive, chiefly because they are so highly variable from place to place and because they defy practical classification. They do not conform to any published single-criterion or several-criteria systems. It is therefore recommended that such waters be characterized by means of a larger cluster of physi-

cal and chemical measurements: width, flow, current speed, substrate, summer temperatures, winter temperatures, turbidity, total dissolved organic matter, total dissolved inorganic matter, water hardness, dissolved oxygen, rooted aquatics, and streamside vegetation. Any two lotic stretches that are similar with reference to these features will have parallel groups of genera and species in their biotic communities. (See also W80-01897) (Otello-Mass)
W80-01899

2F. Groundwater

CALCULATION OF AQUIFER PARAMETERS FROM SPARSE DATA,
Central Water Planning Unit, Reading (England).
A. B. Birtles, and E. H. Morel.
Water Resources Research, Vol 15, No 4, p 832-844, August 1979. 11 Fig, 2 Tab, 16 Ref, 1 Append.

Descriptors: *Model studies, *Aquifer characteristics, *Water levels, *Data processing, Calibrations, Artesian heads, Groundwater movement, Observation wells, Computer models, Transmissivity, Storage coefficient, *England, Inverse problem, Chalk aquifers.

Automatic methods used for the calibration of regional groundwater models are notoriously sensitive to inadequacies in hydrological data used to determine the groundwater regime. The situation is often aggravated by errors introduced by manual interpolation to give estimates of piezometric head between observation boreholes, particularly in areas where these are sparse or locally nonexistent. In this paper a new technique was proposed for the automatic interpolation of groundwater level data that are scattered thinly over a regional aquifer system and the simultaneous determination of transmissivity and storage coefficient distributions. The method makes full use of all available information, and it is consistent with the two-dimensional groundwater flow equations. Results were given to illustrate the success achieved by the method in a practical application. (Visocky-ISWS)
W80-01707

STORAGE COEFFICIENTS FROM GROUND WATER MAPS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W80-01736

SUBSURFACE DRAINAGE FLOWS UNDER NATURAL RAINFALL CONDITIONS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Engineering.
S. Ram, H. S. Chauhan, and P. Singh.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resource (8 Vol), Mexico, April 23-27, 1979. International Water Resources Association, Washington, DC, p 325-333, 1979. 3 Fig, 2 Tab, 11 Ref.

Descriptors: *Subsurface drainage, *Subsurface runoff, *Tile drainage, *On-site tests, Hydrographs, Rainfall, Conveyance structures, On-site investigations, Flow, Soils, Hydraulic conductivity, Hydrologic budget, Loam, Silts, Sands, Foreign research, *India, Tile spacing.

Field experiments on subsurface drainage were made in the high water table area of northern humid plains of Himalayan range in India at Pantnagar to study the drainage characteristics under natural rainfall conditions. Tile flow hydrographs for drain spacings of 35, 25, and 15 m and drain depth of 1 m were collectd for a number of natural storms. Average hydraulic conductivity of the soil was 46.6 cm per day. Four typical hydrographs of rainfall depths ranging from 0.6 to 5.15 cm were analyzed to arrive at the following conclusions: (1) The total tile flow considered per unit of drained area was highest in the narrowest spacing. The title at farthest spacing removed the lowest total volume for all the rainfall depths under study. (2) The tile flow as percentage of rainfall depth increased with increase in rainfall depth. The average runoff varied from 12.65 to 53.53% for drain spacings of 35 to 15 m considering the rainfall depth ranging from 1.2 cm to 5.15 cm, respectively. (3) For low rainfall depth of 0.6 cm, the tile flow ranged from 5.55 to 11.2% for drain spacing of 35 to 15 m, indicating that the tile flow tends to even out for lower rainfall depths. (Humphreys-ISWS)
W80-01807

A CASE STUDY OF DRAINAGE INVESTIGATIONS AT GOVERNMENT AGRICULTURAL FARM, HANSI AND ITS ADJOINING AREAS,
Haryana Agricultural Univ. (India).
M. C. Agarwal, R. Kumar, and J. Singh.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washinton, DC, p 386-393, 1979. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Groundwater, *On-site investigations, *Water table, *Drainage, Maps, Water quality, Surface drainage, Water levels, Rainfalls, On-site data collections, Foreign research, *India.

Drainage investigations in area composed of 960 hectares were carried out with a view to assess the existing state, the extent and degree of drainage problems, and to identify exactly when and which areas suffer from unfavorable groundwater conditions. Detailed surveys of groundwater conditions in the area were carried out by installing 76 observation wells in a grid system, and groundwater table depths were recorded once each month from 1973 to 1977. Groundwater contour maps, isobath maps, and quality maps have been prepared for each month. The graphs showing groundwater table conditions for each year were included and discussed. The hydraulic conductivity in situ and transmissibility of soil formation have been estimted. The effect of rainfall pattern and canal water supply schedule on water table fluctuation has also been studied. On the basis of above investigations, it may be stated that there are no serious problems of water logging in the area, and whatsoever little problem exists over a small area close to irrigation canal, especially during the monsoon period, can be ameliorated by providing speedy disposal of excess rainfall by proper surface drainage or by storing rainwater in dugout ponds. The area has good subsurface natural drainage and there is no need for tile drainage. (Humphreys-ISWS)
W80-01808

THE INFLUENCE OF DENSITY DIFFERENCES ON THE DISPERSION PROCESS IN SATURATED POROUS MEDIA,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
K. Ambo.
In: Progress Report No 48, p 9-16, April 1979. 6 Fig, 3 Ref.

Descriptors: *Porous media, *Dispersion, *Saturated flow, *Injection, Aquifers, Density, Analytical techniques, Analysis, Groundwater movement, Laboratory tests, Water temperature, Heated water, Dispersion coefficient.

The presence of density differences entirely changes the dispersion process in miscible displacements in saturated porous media. The injection of hot water into heavier cold water and vice versa was studied experimentally. The main results regarding the dispersion process were presented. During an initial period, the dispersion process behaves non Fickian, but after some time, which depends on the physical properties of fluid and porous matrix, dispersion following Fick's law is developed. The resulting dispersion coefficient may be larger by one or more orders of magnitude than the usual coefficient of dispersion. (Humphreys-ISWS)
W80-01810

STREAM DEPLETION BY WELLS IN CASE OF A NON-PENETRATING CONFINING STREAMBED,
Technical Univ. of Denmark, Lyngy. Inst. of Hydrodynamics and Hydraulic Engineering.
O. Stang.
In: Progress Report No 48, p 17-23, April 1979. 2 Fig, 4 Ref.

Descriptors: *Streams, *Withdrawal, *Aquifers, *Groundwatr movement, Model studies, Mathematical models, Theoretical analysis, Analytical techniques, Analysis, Wells, Drawdown, Pumping, Foreign research, *Denmark, Stream depletion.

Since many streams in Denmark and particularly the ones on Zealand are formed in the upper boulder clay deposits, and thus are separated from the main confined aquifers by horizontal semipervious beds, there is a need for a quantitative evaluation of the problem. In order to obtain relatively simple solutions to the groundwater flow problem, the following assumptions were made: (1) The aquifer is isotropic, homogeneous and infinite in areal extent. (2) In cases of unconfined aquifers, the gradients of head are small, so that vertical flow components may be neglected. (3) The transmissivity and storage coefficient remain constant in time. (4) The well is screened over the entire depth of the aquifer and the rate of pumping is constant with time. (5) Water is released instantaneously from aquifer and semipervious beds. (6) The stream of width is considered a mathematical line and is the sole source of recharge. (7) The variation of water level in the stream caused by changes of discharge is neglected. (8) The permeability of the confining streambed is much smaller than the permeability of the aquifer, so that the leakage through the streambed can be considered vertical. It was shown that the derived mathematical model will, for practical purposes, give results of satisfactory accuracy under Danish conditions where wells are often placed relatively close to streams. (Humphreys-ISWS)
W80-01811

THE TRANSITION PROBLEM IN PUMPED AQUIFERS,
Bridgeport Hydraulic Co., CT.
M. L. Johnson, and W. F. Brutsaert.
Water Resources Research, Vol 15, No 5, p 1266-1272, October 1979. 14 Fig, 2 Tab, 8 Ref. NSF ENG 75-10179.

Descriptors: *Aquifers, *Mathematical models, *Groundwater movement, *Water table, Analytical techniques, Analysis, Drawdown, Model studies, Flow, Aquifer characteristics, Finite element analysis, Pumping, Wells, Groundwater, Potentiometric level, Saturated flow, Theis equation, Free surfaces, Pumped aquifers.

Confined aquifers may develop water table conditions near the well bore, and under prolonged pumping stresses, this condition may spread to the recharge area. This situation is defined as the transition problem. The physics of the transition problem was examined by modeling well flow with a finite difference computer simulator. The computer simulator is based on two-dimensional, two-phase flow and takes into consideration formation compressibility, fluid (air and water) compressibility, solubility of air in water, and a seepage face boundary condition at the well bore. A fully implicit finite difference scheme was used to solve the nonlinear flow equations by employing a modified Newton iteration process. The results obtained in this study agreed with field data. Current analytical approaches seem to overestimate drawdown levels in time. The analysis showed that the transition problem is a unique combination of confined and unconfined flow. Gravity flow near the well bore appears to dominate the total flow pattern and affects drawdown at farther distances from the well bore where flow is radial. It was also shown that partially penetrating wells behave much like fully penetrating wells at certain radial distances from the well bore. The numerical simulator can be used in the management of aquifers undergoing transition from confined to unconfined conditions. From an energy conservation viewpoint, water table conditions near the well bore are to be pre-

ferred over preventive measures such as casing off the upper portion of the aquifer. (Humphreys-ISWS)
W80-01814

ANALYSIS OF WATER AND HEAT FLOW IN UNSATURATED-SATURATED POROUS MEDIA,
Kansas State Geological Survey, Lawrence.
M. Sophocleous.
Water Resources Research, Vol 15, No 5, p 1195-1206, October 1979. 14 Fig, 7 Tab, 31 Ref.

Descriptors: *Porous media, *Groundwater movement, *Heat flow, *Model studies, Mathematical models, Saturated flow, Unsaturated flow, Evaporation, Temperature, Heat transfer, Soil water, Hydraulic conductivity, On-site investigations, On-site data collections, Analytical techniques.

This work investigated the theoretical and practical aspects of modeling water and heat flow in an unsaturated-saturated flow domain. Field experiments were designed, and complementary laboratory analyses were employed to measure the relevant physical quantities that would enable the significance of non-isothermal effects to be determined. The Philip and de Vries non-isothermal flow model was adapted to the more general pressure (or matric) head-based approach, and a new expression for the thermal liquid water diffusivity was proposed. A general and versatile computer simulation program for modeling coupled non-isothermal transport was developed. The influence of coupling on diurnal subsurface moisture and heat transfer was evaluated by comparing the isothermal and non-isothermal transient numerical solutions to the heat and water transport problem. The results confirmed that coupling does not noticeably influence the temperature field, but coupling does affect the evaporation and subsurface moisture fluxes. The non-isothermal theory was applied to calculate evaporation from dry land surfaces. (Sims-ISWS)
W80-01815

ANALYSIS OF MASS TRANSPORT WITH UNCERTAIN PHYSICAL PARAMETERS,
Princeton Univ., NJ. Dept. of Civil Engineering.
D. H. Tang, and G. F. Pinder.
Water Resources Research, Vol 15, No 5, p 1147-1155, October 1979. 6 Fig, 1 Tab, 8 Ref, 2 Append.
NSF ENG-76-18957.

Descriptors: *Mass transfer, *Groundwater movement, *Model studies, Mathematical models, Groundwater, Permeability, Transmissivity, Soil water, Equations, Dispersion, Physical properties, Analytical techniques, Uncertain parameters.

The coefficients of the mass transport equation are often characterized by considerable uncertainty. Where the functional form of this uncertainty is known, the transport equation can be solved to yield a solution also characterized by uncertainty. The spatial and temporal dependencies of this uncertainty are dependent upon the variance of the velocity and dispersivity, the magnitude of the dispersivity, the functional form of the probability distribution function, and the number of uncertain parameters considered in the analysis. In general the uncertainty, as measured by the coefficient of variation, is considerably smaller for the solution than for the input parameters. While any finite variance theoretically can be accommodated by the method employed for solution of the stochastic partial differential equations, it is nevertheless essential to select numerical parameters (Delta x and Delta t) such that certain constraints on the form of the coefficient matrix are not violated. (Sims-ISWS)
W80-01817

A GENERALIZED SOLUTION FOR SOLUTE FLOW IN SOILS WITH MOBILE AND IMMOBILE WATER,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
F. DeSmedt, and P. J. Wierenga.
Water Resources Research, Vol 15, No 5, p 1137-1141, October 1979. 3 Fig, 1 Tab, 29 Ref. EIA 803565.

Descriptors: *Groundwater movement, *Solutes, *Porous media, *Model studies, Mathematical models, Groundwater, Permeability, Flow, Soils, Mathematics, Equations, Analytical techniques.

An analytical solution was presented for the movement of a solute through a porous medium which is leached at a constant rate. The solution takes into account transfer into an immobile water fraction. The generalized solution is valid for both finite or semi-inifinite media and for concentration or flux type boundary conditions. The solution consists of a convolution integral of two functions. The first function is the derivative with respect to injected pore volume of the corresponding analytical solution of the solute transfer equation without transfer into immobile water. The second function is the J function, for which series approximations were presented. The influence of the boundary conditions on the solution was discussed. (Sims-ISWS)
W80-01818

THE USE OF NATURALLY OCCURRING HELIUM TO ESTIMATE GROUNDWATER VELOCITIES FOR STUDIES OF GEOLOGIC STORAGE OF RADIOACTIVE WASTE,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
I. W. Marine.
Water Resources Research, Vol 15, No 5, p 1130-1136, October 1979. 4 Fig, 4 Tab, 13 Ref. DOE AT(07-2)-1.

Descriptors: *Groundwater movement, *Velocity, *Helium, *South Carolina, Sampling, On-site investigations, On-site data collections, Geochemistry, Isotope studies, Uranium radioisotopes, Geology, Rocks, Crystalline rocks, Groundwater, Gases, Permeability, Radioactive wastes, Thorium.

Most hydrogeologic tests to determine suitable geologic sites for disposal of radioactive waste are of short duration when compared to the time span required in the assessment of the safety of the facility. Geochemical studies of fluid and rock offer an opportunity to examine natural processes that have been going on for a period of time comparable to that required for safe retention of radioactive waste. In a study assessing the potential for storing radioactive waste in metamorphic rock at the Savannah River Plant near Aiken, South Carolina, the rate of water movement was determined to be about 0.06 m/yr by analyzing gas dissolved in the water. The gas contained up to 6% helium, which originated from the radioactive decay of natural uranium and thorium in the crystalline rock. The residence time of the water in the rock was calculated to be 840,000 years from the quantity of uranium and thorium in the rock, its rate of radioactive decay, and the quantity of helium dissolved in the water. From this residence time and a flow path of 51 km, the average velocity of water through the rock was estimated. This water velocity, which is an average over a broad region (51 km) and a long time period (840,000 years), is more applicable to the assessment of a geologic site for storage of radioactive waste than are velocities estimated from packer tests, pumping tests, or artificial tracer tests, all of which require extensive time and space extrapolations. (Sims-ISWS)
W80-01819

A SHORT-TERM FLOOD FORECASTING MODEL BASED ON RETENTION HYSTERESIS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01820

EXPERIMENTAL AND NUMERICAL STUDY OF A TRANSIENT, TWO-DIMENSIONAL UNSATURATED-SATURATED WATER TABLE RECHARGE PROBLEM,
Grenoble-1 Univ. (France). Inst. de Mecanique.
M. Vauclin, D. Khanji, and G. Vachaud.
Water Resources Research, Vol 15, No 5, p 1089-1101, October 1979. 16 Fig, 1 Tab, 19 Ref.

Descriptors: *Groundwater recharge, *Model studies, *Water table aquifers, *Numerical analysis, *Unsaturated flow, *Saturated flow, Infiltration, Trenches, Hydraulic conductivity, Porosity, Unsteady flow, Water transfer, Two dimensional flow, Viscous flow models.

Transient, two-dimensional water flow was studied in relation to the recharge of a water table aquifer The approach was based on the physics of water transfer in the complete domain defined by both the saturated and unsaturated zones of soil. Experimental data were first obtained in a slab of soil (3 m in length, 2 m in height, and 5 cm in thickness) in which the changes of water content and water pressure occurring in the flow domain were measured throughout an artificial recharge event. These were compared with the predictions of a numerical model based on the continuity of transfer between the unsaturated and saturated zones. The validity of the model was proved by the excellent agreement between simulated and experimental results Furthermore, comparison with the results obtained by a viscous flow analog revealed the errors associated with the traditional free surface approach, which neglects transfer in the unsaturated zone. (Visocky-ISWS)
W80-01822

DISPERSION IN STRATIFIED POROUS MEDIA: ANALYTICAL SOLUTIONS,
Birmingham Univ. (England). Dept. of Civil Engineering.
A. N. S. Al-Niami, and K. R. Rushton.
Water Resources Research, Vol 15, No 5, p 1044-1048, October 1979. 4 Fig, 2 Tab, 8 Ref, 1 Append

Descriptors: *Dispersion, *Porous media, *Stratification, *Mathematical models, Equations, Velocity, Flow, Groundwater movement, Density, Theoretical analysis, Analytical solutions.

Analytical solutions were presented for dispersion in stratified porous media. Two different situations were considered, namely, flow parallel to the stratifications and flow perpendicular to the stratifications. Numerical examples were selected to illustrate certain of the trends. (Visocky-ISWS)
W80-01824

THE EFFECT OF WATERTABLE FLUCTUATIONS ON WATER QUALITY: A CASE HISTORY,
Andhra Univ., Waltair (India).
C. S. Rao
Indian Journal of Meteorology, Hydrology, and Geophysics, Vol 29, No 4, p 691-694, October 1978. 6 Fig, 2 Tab, 6 Ref

Descriptors: *Water table, *Water level fluctuations, *Water quality, *Salinity, Geochemistry, Geologic control, Chemical reactions, Soil chemistry, Resistivity, Clays, Loam, Cation exchange, Adsorption, *India.

The effect of water table fluctuations on groundwater salinity was observed for three well waters near Visakhapatnam, India. The electrical resistivity of water sample in the well is taken to represent the salinity of water. A correlation between the electrical resistivities of groundwater samples and the corresponding watertable positions over a period of 15 months was brought out. A peculiar in-phase relation between the water level hydrograph and the salinity curve was recorded, the explanation for which was given in terms of the hydrogeology of the layers constituting the 'host' rock. (Visocky-ISWS)
W80-01830

HYDROLOGIC INVESTIGATIONS FOR WATER RESOURCES, WATER POLLUTION AND CIVIL ENGINEERING OPERATIONS USING ISOTOPE TECHNIQUES,
Bhabha Atomic Research Centre, Bombay (India).
U. Chandra, W. Drost, H. Moser, and F.

Neumaier.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 4, p 629-642, October 1978. 11 Fig, 1 Tab, 24 Ref.

Descriptors: *Groundwater, *Groundwater movement, *Isotope studies, Instrumentation, Equipment, Boreholes, Filtration, Seepage, Tracers, Water pollution, Path of pollutants, Water supply, Water resources, Wells, Water wells, Pumping, On-site investigations.

A number of hydrologic studies for groundwater resources, water pollution, and civil engineering investigations were reported. Measuring methods and instrumentation developed lately were outlined. The field studies carried out in alluvils covered investigations for comparison of borehole dilution technique and conventional pumping tests; groundwater supply to an industrial plant; installation of a well gallery for drinking water in a valley; determination of protection zone of a pumping site; pollution of groundwater around garbage dumps and nuclear installations; construction of foundations; seepage from dams; etc. The investigations carried out in fractured and karstic aquifers included field measurements of seepage rates of a dam built in basaltic aquifer and determination of inflow in a karstic well. The possibility of measuring vertical fow of groundwater even in borings in a fractured or karstic aquifer was practically demonstrated. (Sims-ISWS)
W80-01833

ANALYTICAL NOTE--FLUORESCEIN TRACER TECHNIQUE FOR DETECTION OF GROUNDWATER CONTAMINATION,
Bender Hygienic Lab., Albany, NY.
For primary bibliographic entry see Field 5B.
W80-01835

GROUNDWATER EXPLORATION AND DEVELOPMENT TECHNIQUES,
Portland Water Bureau, OR.
R. F. Willis.
Journal of the American Water Works Association, Vol 71, No 10, p 556-561, October 1979. 5 Fig, 4 Ref.

Descriptors: *Groundwater availability, *Oregon, *Aquifer testing, *Exploration, *Borehole geophysics, *Resistivity, Subsurface investigations, Test wells, Water wells, Radioactive dating, Carbon radioisotopes, Cost comparisons, Collector wells, Ring wells, Development techniques.

Many techniques are available for exploring for groundwater and for developing the source when it is located. Groundwater exploration is undertaken when the quantity and quality of the desired water is known, but not where the water is located. Groundwater development is the means by which a known groundwater source is brought into production. Many of the techniques described in this article were successfully employed by the Portland (Oregon) Water Bureau in its recent groundwater exploration and development project. (Visocky-ISWS)
W80-01836

DETERMINATION OF AQUIFER TRANSPORT PARAMETERS,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie.
G. Hibsch, and A. Kreft.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14833, p 1137-1151, September 1979. 2 Fig, 1 Tab, 22 Ref, 3 Append.

Descriptors: *Groundwater, *Dispersion, *Aquifer characteristics, *Groundwater movement, *Analytical techniques, Aquifers, Analysis, Mass transfer, Observation wells, Tracers, Mathematical models, Velocity, Radioisotopes, Dispersion coefficients, Radioactive tracers.

The mathematical simulation of dispersive pollution transport for any groundwater field is possible, provided all physical parameters appearing in the governing partial differential equation are defined. The present work dealt with determining the flow velocity, flow direction, and longitudinal and transverse dispersion coefficients. A use of the multi-well tracer technique with instantaneous input was suggested. An original method for solving the inverse problem was derived. This method provides possibility of simultaneously determining all four above mentioned parameters from the experiment involving only two observation wells. The identification procedure was based upon fitting the analytical linearized model to experimental data. The favorable geometric conditions for setting up the field experiment were given. The method was tested on computer-simulated data sets. (Adams-ISWS)
W80-01877

TARP GROUNDWATER MONITORING, SUMMARY REPORT (OCTOBER, 1976-SEPTEMBER, 1977),
Metropolitan Sanitary District of Greater Chicago, IL. Research and Development Lab.
For primary bibliographic entry see Field 5B.
W80-01896

2G. Water In Soils

STUDIES OF TILLAGE-INDUCED EFFECTS ON HYDRAULIC CONDUCTIVITY.
Purdue Univ., Lafayette, IN. Water Resources Research Center.
S. A. Schroeder, W. C. Moldenhauer, and J. V. Mannering.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-120686, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 117, August 1979. 79 p, 15 Fig, 31 Tab, 54 Ref, 1 Append. OWRT A-050-IND (1).

Descriptors: *Sediments, *Hydraulic conductivity, *Soil management, *Infiltration rates, Suspended loads, Infiltrometer, Soil physical properties, Runoff, Rainfall-runoff relationships, Darcy's Law, Soil aggregates, *Tillage practice, Raub soil, Chalmers soil, Chisel plow, No-till, Conventional tillage.

The infiltration rate of water into soils is a major factor in determining the sediment load of runoff water. This research studied the effects of soil management and tillage practices on several soil types on the rate of infiltration. The purpose was to provide parameter input to an infiltration model which would provide the information for an improved sediment transport model. The study involved two soil types and seven different tillage treatments. The basic infiltration model was a modified Philip's equation. A primary parameter measured was soil moisture conductivity which was done in the field by a method utilizing cumulative surface runoff. Other parameters measured were surface roughness, penetrometer resistance and soil aggregate stability. As with many field infiltration studies, in general there were wide variability of results between replicated plots within a treatment, which made it difficult to arrive at statistical conclusions. There was a trend, however, showing that some of the long term tillage treatments had a positive effect on some soils and aggregate stbility improved the infiltration rate. The method used for estimating the soil moisture conductivity values proved a reliable procedure and was found to be adequate as a parameter in the infiltration equation.
W80-01798

ANALYSIS OF WATER AND HEAT FLOW IN UNSATURATED-SATURATED POROUS MEDIA,
Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 2F.
W80-01815

INFILTRATION AND DRAINAGE CALCULATIONS USING SPATIALLY SCALED HYDRAULIC PROPERTIES,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
A. W. Warrick, and A. Amoozegar-Fard.
Water Resources Research, Vol 15, No 5, p 1116-1120, October 1979. 4 Fig, 2 Tab, 17 Ref. EPA R804751010.

Descriptors: *Infiltration, *Drainage, *Model studies, *Mathematical models, Hydraulic properties, Hydraulic conductivity, Soils, Soil properties, Moisture content, Soil water, Soil water movement, Velocity, Groundwater, Runoff.

Infiltration and drainage results were calculated for spatially varying hydraulic properties. The soil water flow equation was solved in a form valid for scaled soil water characteristics and unsaturated hydraulic conductivities. The single solution was then utilized for individual sites chosen randomly by using a scaling coefficient. This procedure reduced repeated tedious individual calculations to simple algebra or interpolations. Examples included infiltration using semi-analytical forms and drainage based on a single finite difference solution. Monte Carlo simulations were used in most cases. (Sims-ISWS)
W80-01821

THE EFFECT OF WATERTABLE FLUCTUATIONS ON WATER QUALITY: A CASE HISTORY,
Andhra Univ., Waltair (India).
For primary bibliographic entry see Field 2F.
W80-01830

APPARATUS FOR CONTINUOUSLY MEASURING QUANTITATIVE CHANGES IN MOISTURE CONDENSATION AT A SURFACE,
Gesellschaft fuer Strahlen-und Umweltforschung m.b.H., Neuherbert (Germany, F.R.). (Assignee).
C. Bunnenberg, and W. Kuhn.
U. S. Patent No. 4,166,217, 9 p, 5 Fig, 1 Ref; Official Gazette of the United States Patent Office, Vol 985, No 4, p 1005, August 28, 1979.

Descriptors: *Patents, *Measurement, *Moisture, Dew, Condensation, Moisture content, Evaporation, Probes.

The object of the invention is to continuously measure and record, with high sensitivity and accuracy, the natural dew formation on soil and plant substances as well as the evaporation. The measured data is available as electrical signals either digitally or in analog form to be processed accordingly. A continuous measurement apparatus is composed of a dew measuring probe of a natural soil or plant-like material. A radiation source is arranged below the dew measuring probe with respect to the soil surface which emitts beta particles. A beta particle detector faces the radiation source and is located on the opposite side of the dew measuring probe. (Sinha-OEIS)
W80-01997

2H. Lakes

LOW ENERGY MECHANICAL DESTRATIFICATION AND REAERATION OF RESERVOIRS,
Oklahoma Water Resources Research Inst., Stillwater.
J. E. Garton, J. Wilhm, R. E. Punett, D. Barker, and E. Cover.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-115942, Price codes: A05 in paper copy, A01 in microfiche. Final Technical Completion Report, May 1979. 81 p, 16 Fig, 16 Tab, 80 Ref. OWRT C-7603(7250)(1), 14-34-0001-7250.

Descriptors: *Reaeration, *Mining, *Reservoirs, *Thermal stratification, *Destratification, *Methodology, Propeller pumps, Dissolved oxygen, Evaluation.

A cluster of 16 axial flow units was used to destratify a lake having a surface area of 951 hectares. Complete destratification was not achieved. How-

ever, a significant reduction of the anoxic hypolimnion was accomplished. The penetration of a low-velocity jet was limited by density differences and was accurately predicted. Attempts were made to correlate seasonal changes in water near the bottom, the sediments, and physiological changes in benthic invertebrates with the dissolved oxygen content and temperature of the lake water. Examination of the vertical variation of physicochemical conditions indicated that mechanical pumping did not improve water quality of the water 1 m above the bottom at either the 15 m stations in the arms or in the central pool. Particle size decreased with water depth. Organic matter did not vary significantly among stations and seasonal variation was slight. Inorganic phosphorus in the sediment was generally lower in summer than in spring and winter. Phosphorus in the sediments was generally greater at the deeper stations. Minimum sedimentation rates occurred in the central pool. Iron did not show variation with depth. Seasonal trends were observed in sorbed manganese of the sediment. Sediment caloric content decreased significantly throughout the summer. Higher hemolymph ion (Na^+, $K+$, $Cl-$) concentrations for Chironomus tentans and Chaoborus punctipennis were observed at the deep water stations. Oxygen consumption rates of Chaoborus were highest from those collected at the deep water station. Oxygen consumption increased in the sediment column as the water temperature increased, and the oxygen concentration decreased to 0.0 ppm. (Punnett-Okla)
W80-01601

SELECTIVE WITHDRAWAL AND HEATED WATER DISCHARGE: INFLUENCE ON THE WATER QUALITY OF LAKES AND RESERVOIRS PART II - INDUCED MIXING WITH SUBMERGED, HEATED WATER DISCHARGE,
Wisconsin Univ-Madison. Dept. of Civil and Environmental Engineering.
J. A. Hoopes, P. L. Monkmeyer, N. V. Ionescu, K. V. R. Henkel, and V. Alavian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116270, price codes: A05 in papercopy, A01 in microfiche. Technical Report, Water Resources Center, Univ. of Wisconsin Technical Report, WIS SRC 79-04 1979. 93 p. 14 Fig, 33 Ref. OWRT-B-080-WIS(9), 14-31-0001-3550, 3850

Descriptors: *Reservoirs, *Heated water, *Inflow, Effects, Model studies, Lakes, Ponds, Impoundments, Stratified flow, Destratification, Mixing, Submerged discharge, Heated discharge, Water quality, Hydraulics.

Various methods have been proposed to improve the water quality of stratified lakes and reservoirs. Artificial destratification using pumps, air injection and water jets have been successfully employed. Hypolimnetic aeration has been used to remove chemical stratification, leaving the thermal stratification unchanged. This report presents a field and theoretical investigation of the induced, vertical mixing in a temperature stratified impoundment resulting from the submerged discharge of heated water. This work shows that a subsurface, heated water discharge can induce vertical mixing of a stratified impoundment. The feasibility of and considerations in using this method of mixing along with relations, and procedures for applying the results of this study to an impoundment are presented. General relations are developed for the rate of change of stability in a stratified impoundment due to a heated water discharge, atmospheric energy exchange and impoundment inflows and outflows, for the percent of impoundment mixed, and for the mixing time. A numerical model of an impoundment's temperature structure and changes thereto, resulting from a submerged, vertical, heated water discharge and/or atmospheric energy exchange is presented. The model is in good agreement with observations of the natural temperature distribution (no heated water discharge) in two lakes; model predictions show the changes in the 'natural' temperature distribution for one lake induced by a submerged, heated water discharge. (See also W77-08447)
W80-01604

RISE AND COLLAPSE OF AN INTRODUCED FISH, MORNONE MISSISSIPPIENSIS IN CLEAR LAKE, IOWA,
Iowa State Univ., Ames. Dept of Animal Ecology.
For primary bibliographic entry see Field 5C.
W80-01771

LABORATORY STUDY OF FLOW AND THERMAL STRUCTURES IN HEATED AND/OR COOLED LAYERS OF WATER,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
M. Behnia, and R. Viskanta.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-120694, Price codes: A11 in paper copy, A01 in microfiche. Technical Report No 123, August 1979. 213 p, 76 Fig, 5 Tab, 120 Ref, 4 Append. OWRT B-077-IND (5).

Descriptors: *Thermal stratification, *Energy dissipation, *Energy equation, *Heat transfer, Interferometry, Heated water, Convection, Conduction, Radiation, Cooling, Heat budget boundary processes, Energy transfer.

The purpose was to gain an improved understanding of the basic internal transport processes in natural waters and the interactions at the air-water interface. To this end, thermal and flow structure in a stratified layer of water heated by a radiation source and/or cooled by forced air flow over the surface was studied in the laboratory. The transport processes occurring in impounded waters were imulated in a test cell. The experimental observations during thermal stratification of a shallow layer of water indicated if sufficient radient energy is absorbed at and near the bottom, instabilities will occur. Numerical results based on a transient, one-dimensional energy transfer model showed good agreement with experimental measurements. Heating from below of a nonuniformly stratified layer of water was studied to obtan understanding of turbulent mixing processes in an inherently unstable situation. The predictions from a simple thermal model as well as those from a more sophisticated energy model in which turbulence was accounted for agreed very well with the experimental data for the mixed layer height and temperature. Experimental observation during forced air cooling of a layer of water undergoing thermal stratification by radiation indicated a very complex thermal and flow structure. A model based on conservation principles and turbulence was developed which agreed reasonably well with the experimental data. (Wiersma-Ind)
W80-01799

THE PERFORMANCE OF A WAVE GAUGE IN BUBBLY WATER--WHAT DOES IT MEASURE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2L.
W80-01809

WINTERTIME RAW-WATER CONTAMINATION AT CHICAGO'S SOUTH WATER FILTRATION PLANT,
Argonne National Lab., IL.
For primary bibliographic entry see Field 5B.
W80-01886

GREAT LAKES TOTAL PHOSPHORUS BUDGET FOR THE MID 1970S,
National Oceanic and Atmospheric Administration, Ann Arbor, MI.
For primary bibliographic entry see Field 5B.
W80-01887

LAKE CLASSIFICATION--GOOD AND BAD,
Arizona State Univ., Tempe. Dept. of Zoology.
G. E. Cole.
In: Classification, inventory, and analysis of fish and wildlife habitat--the proceedings of a national symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 67-68, 1978. 1 Fig, 36 Ref.

Descriptors: *Systematics, *Lentic environments, *Lakes, Limnology, Geology, Soils, Geological regions, Hydrology, Trophic level, Water chemistry, Water circulation.

A need exists for classifying lakes at a regional level and making comparative reference to relevant categories worldwide. Most categories that exist do not apply on a worldwide basis. Lake classifications have been based on at least: geologic origin, edaphic factors, geographic and hydrologic features, trophic status, water chemistry, annual circulation patterns, the morphoedaphic index, and taxonomic schemes involving chemical, geographic, morphologic, and biotic elements. (See also W80-01897) (Otello-Mass)
W80-01900

ASPECTS OF THE ECOLOGY AND PHYSIOLOGY OF FRESHWATER MACROPHYTES: PHOSPHORUS CYCLING BY FRESHWATER MACROPHYTES: THE CASE OF SHAGAWA LAKE,
Minnesota Univ., Minneapolis.
G. B. Lie.
Ph.D. dissertation, 1977. 72 p.

Descriptors: *Aquatic plants, *Plant physiology, *Phosphorus compounds, *Lakes, Plants, Inorganic compounds, Nutrients, Nutrient cycling, Sedimentation, Wetlands, Epilimnion, Hypolimnion, Lake soils, Limnology, Stratification, Lake shores, Littoral.

Phosphorus release and cycling in three aquatic plant types, Sparganium, Nuphar, and Potamogeton species, growing in a lake ecosystem were measured to determine a phosphorus budget for the lake. Loading of phosphorus from the aquatic plants to Shagawa Lake was determined from a plant census to be 6,354 kg P/year. Surveys of the various phosphorus forms in the hypolimnion, epilimnion, and littoral regions of the lake showed that, at certain times during the summer, there was as much orthophosphorus in the littoral zones (10% of the lake by volume) as there was in the rest of the lake. A phosphorus budget computed for the period when the lake was stratified in 1974 indicated that loading by the aquatic macrophytes and other littoral sources could account for changes in phosphorus in both the epilimnion and the subsequent sedimentation to the hypolimnion. (Elowe-Mass)
W80-01914

SEASONAL CHANGES OF PHRAGMITES COMMUNIS TRIN. PART II. MINERAL CONTENTS,
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
For primary bibliographic entry see Field 2I.
W80-01915

FRESHWATER WETLANDS: THEIR NATURE AND IMPORTANCE TO MAN,
Tufts Univ., Medford, MA. Dept. of Biology.
N. H. Nickerson.
Report prepared for New England Environmental Network, The Lincoln Filene Center for Citizenship and Public Affairs, Tufts University, Medford, Massachusetts. 1978. 8 p. 16 Ref.

Descriptors: *Freshwater marshes, *Value, Wetlands, Marshes, Wildlife habitat, Pesticides, Heavy metals, Flood protection, Groundwater recharge

Wetlands, regardless of size, act in flood prevention and water absorption areas as water dispersal agents, as rechargers of groundwater, as valuable habitat for wildlife during climatic extremes, as denitrifiers of acid rain and excess fertilizers, as adsorbers of heavy metals and pesticides and as supporters of unique flora. (Steiner-Mass)
W80-01928

STATUS OF PRESENT PEATLAND USES FOR AGRICULTURAL AND HORTICULTURAL PEAT PRODUCTION,
Minnesota Univ., Minneapolis. Dept. of Soil Sci-

ence.
R. S. Farnham.
Report prepared for Minnesota Department of Natural Resources, December, 1978. 50 p, 9 Tab, 90 Ref, 2 Append.

Descriptors: *Minnesota, *Peat, *Wetlands, *Census, Horticulture, Arable land, Publications, Land reclamation, Crops, Distribution patterns.

The main emphasis of this study was to evaluate the present uses of peatlands in Minnesota for agricultural and horticultural purposes. In addition, an inventory of current peatland utilization was made including location and extent of peat in state and national forests, in designated state and national wildlife refuges and management areas, recreation areas, natural areas containing peat, and undeveloped peatlands. Information was obtained on the location and extent of the various crops grown on peatlands and data was gathered from farmers concerning major operational problems and current management practices. Peatlands used for commercial horticultural peat production were located on county maps and acreage presently being harvested was determined. A literature survey was made of current agricultural and horticultural uses of peatlands including types of crops, suitability of peatlands, properties of peat, management practices, and problems associated with these developments. Current information on commercial peat production in the U.S. was included and an evaluation made of the potential of Minnesota horticultural peat production in the future. Also, the reclamation potential for mined peatlands was determined. (Steiner-Mass)
W80-01929

2I. Water In Plants

ESTABLISHMENT AND GROWTH OF SELECTED FRESHWATER AND COASTAL MARSH PLANTS IN RELATION TO CHARACTERISTICS OF DREDGED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 2L.
W80-01910

(GROWTH AND CHEMICAL COMPOSITION OF REED (PHRAGMITES AUSTRALLIS) AS RELATED TO WATER EUTROPHICATION), WACHSTUM UND CHEMISCHE ZUSAMMENSETZUG VON SCHILF (PHRAGMITES AUSTRALIS) IN ABHANGIGKEIT VON DER GEWASSEREULTROPHIERUNG.
Technische Univ., Berlin (Germany, F.R.). Inst. fuer Okologie.
For primary bibliographic entry see Field 5C.
W80-01913

ASPECTS OF THE ECOLOGY AND PHYSIOLOGY OF FRESHWATER MACROPHYTES: PHOSPHORUS CYCLING BY FRESHWATER MACROPHYTES: THE CASE OF SHAGAWA LAKE,
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 2H.
W80-01914

SEASONAL CHANGES OF PHRAGMITES COMMUNIS TRIN. PART II. MINERAL CONTENTS,
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
H. Mochacka-Lawacz.
Polskie Archiwum Hydrobiologii, Vol 21, No 3/4, p 369-380, 1974. 10 Fig, 2 Tab, 21 Ref.

Descriptors: *Marsh plants, *Nutrient requirements, *Plant physiology, Wetlands, Lakes, Plant growth, Nutrients, Calcium, Phosphorus.

Mineral contents of parts of reeds were analyzed on six lake reedbeds during two growing seasons. Phenological differences in the contents of particular elements were found, as well as differences between reeds from various sampling grounds and between its morphological parts. In the course of a growing season, the contents of K, Na, P, Fe, and N were decreasing while the amounts of Ca, SiO2, and general ash in dry mass of leaves were increasing. During the biomass maximum of reed, leaves contained most of ash , SiO2, K, and Ca, rhizomes most of Na and Fe and panicles most of P. There were quantitative differences in mineral contents of reed correlated with its distance from the shoreline. The greatest proportion of ash was recorded in reed from shore zones, inundated temporarily. Greater amounts of phosphorus were in general found in stems and leaves of taller reed, with greater biomass, independent of its distance from the shore. (Steiner-Mass)
W80-01915

INLAND HALOPHYTES OF THE UNITED STATES,
Ohio Univ., Athens, Dept. of Botany.
I. A. Ungar.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.), Academic Press, Inc., New York, p 235-305, 1974. 27 Tab, 181 Ref.

Descriptors: *Halophytes, *Marsh plants, *Desert plants, Wetlands, Salt marshes, Marshes, Salt tolerance, Distribution patterns.

Distinct community zonation is often found in inland saline marshes even though physical gradients of moisture, aeration, and salinity may vary continuously. The development of distinct communities seems to be a response to edaphic factors; however, laboratory experiments indicate that halophytes have broader tolerances to salinity than observed in the field. Halophytes are apparently limited to saline extreme environments because they can tolerate low water potentials and not due to a physiological requirement for excess salts. Competitive exclusion may explain their elimination from moderate sites. Even halophytes when near their tolerance limits, respond to increase salinity with a decrease in vigor, density, and cover. Species diversity is lowest in the most saline soils and reaches its maximum in non-saline soils. (Steiner-Mass)
W80-01916

THE EFFECTS OF BISULPHITE AND SULPHATE UPON PHOTOSYNTHESIS IN SPHAGNUM,
Victoria Univ. of Manchester (England). Dept. of Botany.
P. Ferguson, and J. A. Lee.
New Phytologist, Vol 82, p 703-712, 1979. 2 Fig, 4 Tab, 28 Ref.

Descriptors: *Mosses, *Plant physiology, *Photosynthesis, *Bogs, *Air pollution, *Sulfur compounds, Plants, Fens, Wetlands, Pollution, Environmental effects, Air pollution effects, Mires.

Laboratory measurements of photosynthetic oxygen evolution in Sphagnum spp. exposed to varying concentrations of HSO3(-) and SO4(--) indicate that at certain concentrations, photosynthesis may be reduced by 50%. Almost instantaneous reductions induced by HSO3(-), the magnitude of which increased with concentration, were not reversed by additions of HCO3(-). SO3(--) had no effect on oxygen evolution. Effects of HSO3(-) were markedly pH dependent, being much greater at lower pH. Radiocarbon uptake was less sensitive to HSO3(-) than oxygen evolution. Low HSO3(-) concentrations enhanced carbon dioxide fixation but never increased oxygen evolution. Dark carbon fixation was inhibited by 0.1 mM HSO3(-), but enhanced by lower concentrations. (Elowe-Mass)
W80-01917

PHYSIOLOGY OF COASTAL HALOPHYTES,
Chesapeake Research Consortium, College Park, MD.
W. H. Queen.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.), Academic Press, Inc., New York, p 345-353, 1974. 37 Ref.

Descriptors: *Halophytes, *Salt tolerance, *Plant physiology, Wetlands, Marsh plants, Enzymes, Literature.

Recent studies of the dual mechanism of ion absorption have provided significant new insights concerning the adaptation of vascular plants to their highly saline environment. Comparable success has not been achieved in the few investigations of the in vitro response of salt--sensitive enzymes of halophytes to high salt concentrations. Data both supporting and refuting the idea that enzymes of halophytes are more tolerant of high ion concentrations than those of glycophytes have been reported. Results of other studies suggest salt-sensitive mechanisms may be protected by cellular ion compartmentalization. (Steiner-Mass)
W80-01918

ECOLOGICAL SIGNIFICANCE OF FOUR CRITICAL ELEMENTS IN PLANTS OF RAISED SPHAGNUM PEAT BOGS,
Department of Agriculture, Ottawa (Ontario). Plant Research Inst.
For primary bibliographic entry see Field 2K.
W80-01919

ECOLOGY AND RESTORATION OF MANGROVE SHORELINES IN FLORIDA,
Miami Univ., Coral Gables, FL. Dept. of Biology.
H. J. Teas.
Environmental Conservation, Vol 4, No 1, p 51-58, Spring, 1977. 7 Fig, 39 Ref.

Descriptors: *Florida, *Aquatic plants, *Planting management, *Vegetation establishment, Swamps, Marshes, Intertidal areas, Coastal marshes, Plants, Marine plants, Soil-water-plant relationship, Plant physiology, Cover crops, Soil management, Wetlands.

Successful establishment of planted mangroves depends on plant size and source, shoreline energy, root parasite prevalence, tidal depth of planting, substrate type, salinity, and vandalism. Younger plants, particularly seedlings, showed a much greater survival rate than transplanted older plants. Florida mangrove species do not appear to require salt for growth and excessive salinity can cause stunted growth, so fresh water plantings may be successful at some sites. A rough estimate of the cost of planting Red Mangrove propagules on 2-foot centers is $1,000/acre or $2,470/hectare. (Elowe-Mass)
W80-01921

SALT MARSH PLANTS AND FUTURE COASTAL SALT MARSHES IN RELATION TO ANIMALS,
Delaware Univ., Newark. Dept. of Biological Sciences.
For primary bibliographic entry see Field 6G.
W80-01923

VASCULAR HALOPHYTES OF THE ATLANTIC AND GULF COASTS OF NORTH AMERICA NORTH OF MEXICO,
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 2L.
W80-01924

UPTAKE OF RADIONUCLIDES BY SOME AQUATIC MACROPHYTES OF ISMAILIA CANAL, EGYPT,
Atomic Energy Establishment, Cairo (Egypt). Radiation Protection Dept.
For primary bibliographic entry see Field 5C.
W80-01925

RESPONSE OF WATER SEDGE IN THE GROWTH ROOM TO FERTILIZER AND TEMPERATURE TREATMENTS,
Department of Agriculture, Kamloops (British Columbia). Research Station.
For primary bibliographic entry see Field 2K.
W80-01926

Group 2I—Water In Plants

IRRIGATION OF CROP AND ORNAMENTAL PLANTS WITH SEA WATER,
Ben-Gurion Univ. of the Negev, Beersheva (Israel). Research and Development Authority.
D. Pasternak, J. Ben Dov, and M. Forti.
Report Number BGUN-RDA-220-79, April 1979. 13 p, 1 Fig, 2 Tab, 7 Ref.

Descriptors: *Crop response, *Irrigation effects, *Sea water, *Halophytes, *Forages, *Salt tolerance, Ornamentals, Agrotechniques, Trickle irrigation, Varieties, Proteins, Salinity.

Results of preliminary experiments to determine the growth, yield and quality of fodder halophytes under sea-water irriation and to explore proper agrotechniques for crop production with sea water are reported. The responses to continuous trickle irrigation with sea water of 38 species were observed on a coarse granite sandy soil with very low water holding capcity in a 525 m2 plot in the seashore grounds of the Hebrew University's Marine Laboratory in Eilat, Israel. Preliminary results made over two test periods of 18 and 4 months each indcated that 26 plant species survived and 7 species grow extremely well. It is concluded that these results demonstrated that many plant species can grow well when irrigated with water containing 4.2% salts and that plants such as Atriplex nummularia will reasonable dry matter yields with high protein contest. An initial list of plants which may serve as a basis for gardens irrigated with sea water is compiled based upon these results. (Tickes-Arizo n)
W80-01953

VEGETATION RESPONSE TO A MOISTURE GRADIENT ON AN EPHEMERAL STREAM IN CENTRAL ARIZONA,
Gila Bend High School, AZ. Biology Dept.
D. A. Bloss, and J. D. Brotherson.
The Great Basin Naturalist, Vol 39, No 2, p 161-176, June 30, 1979. 11 Fig, 5 Tab, 67 Ref.

Descriptors: *Crop response, *Ephemeral streams, *Moisture gradient, *Plant populations, *Soil-water-plant relationships, Niches, Channels, Frequency analysis, Vegetation patterns, Speciation, Environmental effects, Varieties, Soil moisture, Flood plains, Slopes, On-site data collections, Arizona.

Vegetational zonation patterns along an ephemeral stream in Central Arizona were studied at 10 sites at half-mile intervals, to determine if such observable patterns represented a continuum adapted to a moisture gradient from slope to stream channel, or if they represented distinct, discrete communities. At each of the 10 sites, five stands were selected, one each on both slopes adjacent to the channel, the flood plain on both sides of the channel, and the stream channel itself. Analysis of frequency data and vegetation patterns indicated that a moisture gradient from mesic to xeric prevailed in the flood plain as well as the slopes, where vegetation sometimes integrated but at other locations maintained sharp delineations. Cluster analysis showed that trees and legumes preferred mid-moisture habitats; forbs, shrubs, and succulents preferred a drier environment; and certain family groups were distributed generally. While diversity increased directly with moisture, being highest on the slopes and lowest in the flood plain, it is believed that disturbance was equally a factor. (Tickes-Arizona)
W80-01957

GERMINATION AND SURVIVAL OF PERENNIAL PLANT SPECIES IN THE MOJAVE DESERT,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
T. L. Ackerman.
The Southwest Naturalist, Vol 24, No 3, p 399-408, Sept 15, 1979. 3 Tab, 26 Ref.

Descriptors: *Soil-water-plant relationships, *Soil moisture, *Water requirements, *Hydrobiology, *Rainfall disposition, *Plant growth, Germination, Perennial plants, Arid lands, Temperature, Desert plants, Viability, Shrubs.

The germination of perennial desert plant species depends principally upon the suitability of both temperature and rainfall, and is generally low in undisturbed arid regions. Reported here are the quantitative results of a study to determine the germination and survival patterns of 11 perennial plant species between 1971 and 1977 in Rock Valley, Nye County, Nevada. In the spring of 1971, 780 permanent quadrants were established to estimate the density of annual plants occupying the area, and 4 quadrants were distributed 10m north, south, east and west of each of 195 randomly distributed points to record the germination of 11 seedling species between 1971 and survival of seedlings until 1977. Results indicated that the species Larrea tridentata and Ambrosia dumosa germinated after rains of 25mm between mid June and Sept., while Atriplex confertifolia, Ceratoides lanata, Ephedra nevadensis, Grayia spinosa and 5 other species germinated between Oct. and March after rains of 16mm. Only one of 201 seedlings which germinated between 1971 and 1975 survived until the spring of 1977. (Tickes-Arizona)
W80-01959

APPARATUS FOR CONTINUOUSLY MEASURING QUANTITATIVE CHANGES IN MOISTURE CONDENSATION AT A SURFACE,
Gesellschaft fuer Strahlen-und Umweltforschung m.b.H., Neuherbert (Germany, F.R.). (Assignee).
For primary bibliographic entry see Field 2G.
W80-01997

2J. Erosion and Sedimentation

AN EXPERIMENTAL STUDY OF HYDRAULIC AND GEOMORPHIC CHANGES IN AN ALLUVIAL CHANNEL INDUCED BY FAILURE OF A DAM,
Colorado State Univ., Fort Collins. Engineering Research Center.
For primary bibliographic entry see Field 2E.
W80-01816

SEASONAL PATTERNS OF ONSHORE/OFFSHORE SEDIMENT MOVEMENT,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2L.
W80-01832

PREFERENTIAL CLAY MINERAL EROSION FROM WATERSHEDS IN THE MAUMEE RIVER BASIN,
Northeastern Forest Experiment Station, Berea, KY.
F. E. Rhoton, N. E. Smeck, and L. P. Wilding.
Journal of Environmental Quality, Vol 8, No 4, p 547-550, October-December 1979. 3 Fig, 4 Tab, 21 Ref.

Descriptors: *Erosion, *Sediments, *Clay minerals, *Ohio, Sampling, Suspended solids, Clays, Expansive clays, Illite, Quartz, Iron, Iron oxides, Cations, Cation exchange, Particle size, Soils, Watersheds(Basins), Sedimentology, *Maumee River(OH).

Runoff sediments and soil surface horizons from 5 small watersheds were characterized for clay mineralogy, particle size distribution, cation exchange capacity, and amorphous and free iron oxide content. The objective was to determine if preferential transport of clay minerals from these watersheds was occurring. Clay mineralogical analysis indicated runoff sediments contained higher concentrations of illite and expandables with lower concentrations of vermiculite and quartz relative to watershed soils. The differences were attributed to preferential transport of fine clays from the soil surface. Runoff sediments contained an average of 18.4% more clay than soil surface horizons. Additionally, the total clay fraction of sediments contained an average of 10.1% more fine clay. Cation exchange capacity increased from 41 meq/100 g for soil clay fractions to 46 meq/100 g for sediment clay fractions due to the increased fine clay content. Both amorphous and free iron oxide contents were lower in the clay fractions of runoff sediments than in the clay fractions of soil Ap horizons. (Sims-ISWS)
W80-01837

SOIL CONSERVATION LIMITATIONS ON REMOVAL OF CROP RESIDUES FOR ENERGY PRODUCTION,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Lab.
M. J. Lindstrom, E. L. Skidmore, S. C. Gupta, and C. A. Onstad.
Journal of Environmental Quality, Vol 8, No 4, p 533-537, October-December 1979. 1 Fig, 6 Tab, 18 Ref.

Descriptors: *Erosion, *Soil erosion, *Erosion control, *Great Plains, *Corn belt, Farm management, Wind erosion, Rill erosion, Sheet erosion, Soils, Crops, Corn(Field), Grain sorghum, Wheat, Oats, Barley, Erosion rates, Crop residues, Residue management, Residue removal.

Potential soil erosion by water for Major Land Resource Areas in the Corn Belt and by wind in the Great Plains was calculated using the Universal Soil Loss Equation and the Wind Erosion Equation for current cropping practices. Crop statistics and components of the erosion equations were obtained from the States Crop Reporting Service, Soil Conservation Service, and information available from related literature. The calculations showed that only limited quantities of residue can be removed safety from either region because of soil erosion potentials. In the Corn Belt, under conventional tillage with all residues removed, only 36% of the cultivated area would have a soil loss at less than the soil loss tolerance level. Residue and tillage management can increase the area adequately protected to 78%. In the Great Plains, only 40 and 56% of the cultivated area produce enough residue to hold soil loss by wind at 6.7 and 11.2 metric tons/ha per year, respectively, when the fields are wide and the soil surface is smooth, i.e., K = 1.0. Increasing soil surface roughness, K = 0.5, increases the cultivated area to 81% where enough residue is produced to maintain a soil loss level of 11.2 metric tons/ha per year. (Sims-ISWS)
W80-01839

APPLICATION OF FORMALDOXIME COLORIMETRIC METHOD FOR THE DETERMINATION OF MANGANESE IN THE PORE WATER OF ANOXIC ESTUARINE SEDIMENTS,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2L.
W80-01841

COMPARATIVE EROSION RATES OF LOESS SOILS IN POLAND AND IOWA,
Science and Education Administration, Columbia, MO.
R. F. Piest, and S. Ziemnicki.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 822-827, 833, July-August 1979. 7 Fig, 3 Tab, 19 Ref

Descriptors: *Erosion, *Soil erosion, *Loess, *Iowa, Sheet erosion, Rill erosion, Erosion rates, Gullies, Soil types, Particle size, Crops, Farm management, Roads, *Poland.

The erosion consequences of historic land management in the loess hills region western Iowa were evaluated by comparison with similar loess terrain in Poland. Application of the Universal Soil Loss Equation, using inputs based on available cropping, management, topographic, soils, and climatic data, indicated that the Iowa sheet-rill erosion rates are more than double those in Poland, primarily due to the greater rainfall erosivity and field slope length. Gullying is serious at both locations, although present Polish gullying rates are probably less than historic rates and present Iowa rates. (Sims-ISWS)
W80-01853

WHEEL TRAFFIC CONSIDERATIONS IN EROSION RESEARCH,

Science and Education Administration, Morris, MN.
W. B. Voorhees, R. A. Young, and L. Lyles.
Transactions of the American Society of Agricultural Enineers, Vol 22, No 4, p 786-790, July-August 1979. 3 Fig, 5 Tab, 23 Ref.

Descriptors: *Soil erosion, *Soil compaction, *Erosion, *Runoff, On-site investigations, Bulk density, Aggregates, Soil aggregates, Stability, Soil properties, Soil moisture, Soil structure, Agriculture, Wheel traffic.

Recent field experiments in Minnesota showed that wheel traffic from farming operations may compact the soil to a depth of 300 mm or more. This compaction can persist despite tillage, freezing, and thawing. Thus, bulk density, aggregate size and stability, random roughness of the soil surface, infiltration rate, and other erosion-related soil properties are changed. This can cause concentrated areas of different soil properties and drastically alter erosion on research plots. Effects of wheel traffic could bias the erosion results of the actual treatment under investigation. This paper described how wheel-induced compaction may alter erosion results. (Sims-ISWS)
W80-01857

LABORATORY STUDY OF CYLINDRICAL SEDIMENTATION TRAPS,
National Water Research Inst., Burlington (Ontario). Hydraulics Research Div.
Y. L. Lau.
Journal of the Fisheries Research Board of Canada, Vol 36, No 10, p 1288-1291, October 1979. 2 Fig, 5 Ref.

Descriptors: *Sedimentation, *Trap efficiency, *Laboratory tests, *Limnology, Hydraulic models, Testing procedures, Sampling, Flow, Open channels, Reynolds number, Instrumentation, Sediment traps, Cylindrical sediment trap.

Observations of the motion of fluid particles in cylindrical sedimentation traps showed that with an increase of the aspect ratio, there is also an increase in the Reynolds number below which neturally buoyant droplets that were placed near the floor of the trap would remain in the bottom layer. The dependence of the fluid motion on these two dimensionless variables were demonstrated using traps of different diameters. For single cylindrical traps, the experimental results can be used to obtain estimates of the Reynolds number below which resuspension of settled material would not be expected to occur. (Humphreys-ISWS)
W80-01871

SUSPENDED SEDIMENT-PHOSPHORUS RELATIONSHIPS FOR THE INFLOW AND OUTFLOW OF A FLOOD DETENTION RESERVOIR,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W80-01872

PARTICLE-SIZE ANALYSIS BY PIPETTE AND SEDIGRAPH,
Science and Education Administration, Chickasha, OK. Southern Region.
N. H. Welch, P. B. Allen, and D. J. Galindo.
Journal of Environmental Quality, Vol 8, No 4, p 543-546, October-December 1979. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Particle size, *Sediments, *Analytical techniques, Laboratory tests, Methodology, Equipment, Measurements, Regression analysis, Correlation analysis, Bottom sediments, Lake sediments, Sedimentation, Sedimentology, Comparison of methods, Fractionation, Sedimentation methods.

The pipette and SediGraph methods of particle size analyses were compared on 55 samples. The best agreement between the two methods was on 12 of the 55 samples treated to remove organic matter and soluble salts. The correlation for all sizes combined from the 55 samples was 0.97, with a standard deviation from regression of 5.54%. The agreement between the two methods was good at all individual sizes except the % less than 50 micrometers where the correlation was 0.12. Neither method is well suited to particle size analysis of suspended sediment samples with low concentrations or limited quantities of sediment. The major differences between the two methods are the time and labor required to perform the actual analysis and to calculate the analytical results. (Sims-ISWS)
W80-01874

HYDRAULIC GEOMETRY OF ACTIVE GRAVEL RIVERS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01878

GRAVEL SIZE ANALYSIS FROM PHOTOGRAPHS,
Cornell Univ., Ithaca, NY. Dept. of Geological Science.
For primary bibliographic entry see Field 2E.
W80-01881

UNSTEADY FLOW IN STRAIGHT ALLUVIAL STREAMS: MODIFICATION OF INDIVIDUAL DUNES,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
J. Fredsoe.
Journal of Fluid Mechanics, Vol 91, Part 3, p 497-512, 1979. 7 Fig, 2 Tab, 15 Ref.

Descriptors: *Alluvial channels, *Sediment transport, *Dunes, *Mathematical models, Unsteady flow, River beds, Discharge(Water), Channel erosion, Moement, Model studies, Theoretical analysis, Analytical techniques, Bed load, laboratory tests.

Changes in dune properties due to a sudden change in the water discharge were analyzed. The transport of sediment was assumed to occur mainly as bed load, and the square of the Froude number must be much smaller than unity. The theory was based on similarity in the bed-shear distribution close to the dune top just before and just after the change in the water discharge. The model was found to agree with laboratory experiments. Further, by use of this model, flow in a river where the water discharge oscillates weakly around a constant mean value was treated. The variation in the phase differences between sediment transport, water depth, and water discharge with the period of the oscillation was calculated. The results agreed qualitatively with observations. (Humphreys-ISWS)
W80-01893

ERODIBILITY OF SURFACE-MINE SPOIL BANKS IN SOUTHEASTERN OHIO: AN APPROXIMATION,
Ohio State Univ., Columbus. Dept. of Geology and Mineralogy.
C. D. McKenzie, and J. R. J. Studlick.
Journal of Soil and Water Conservation, Vol 34, No 4, p 187-190, July-August 1979. 2 Fig, 4 Tab, 40 Ref.

Descriptors: *Erosion, *Spoil banks, *Strip mines, *Ohio, Sediments, Equations, Model studies, Mathematical models, On-site investigations, Soils, Rocks, Topography, Slopes, Erosion rates, Soil erosion, Mining, *Gallia County(OH).

Meaasurements of accumulated sediment in interbank basins of unreclaimed strip mines determined the average annual soil loss from unvegetated, 18-year-old spoil banks. Assuming the universal soil loss equation (USLE) can be used to estimate sediment yield from strip mine slopes, the topographic factor in the USLE was determined in two ways, and values for erodibility (K) were calculated. The technique is applicable to unreclaimed mines where interbank basins trap all slope-derived sediment. (Sims-ISWS)
W80-01894

2K. Chemical Processes

THE EFFECT OF WATERTABLE FLUCTUATIONS ON WATER QUALITY: A CASE HISTORY,
Andhra Univ., Waltair (India).
For primary bibliographic entry see Field 2F.
W80-01830

NUTRIENT MOVEMENT IN STREAMFLOW FROM AGRICULTURAL WATERSHEDS IN THE GEORGIA COASTAL PLAIN,
Science and Education Administration, Tifton, GA.
For primary bibliographic entry see Field 5B.
W80-01854

CONTAMINATION OF GREAT SMOKY MOUNTAINS TROUT STREAMS BY EXPOSED ANAKEESTA FORMATIONS,
Western Carolina Univ., Cullowhee, NC. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W80-01873

THE EFFECTS OF BISULPHITE AND SULPHATE UPON PHOTOSYNTHESIS IN SPHAGNUM,
Victoria Univ. of Manchester (England). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-01917

ECOLOGICAL SIGNIFICANCE OF FOUR CRITICAL ELEMENTS IN PLANTS OF RAISED SPHAGNUM PEAT BOGS,
Department of Agriculture, Ottawa (Ontario). Plant Research Inst.
E. Small.
Ecology, Vol 53, No 3, p 498-503, Late Spring, 1972. 4 Fig, 33 Ref.

Descriptors: *Peat bogs, Environments, *Aquatic plants, *Sphagnum bogs, Acid bogs, Aluminum, Manganese, Nitrogen, Phosphorus.

The concentrations of N, P, Mn, and Al in plants of two ombrotrophic bogs and four adjacent environments were examined. The current year's foliage of the evergreen bog species, as contrasted with the older leaves, invariably possessed higher concentrations of N and P and lower concentrations of Al and Mn. Within the bog species, the composition of the current year's foliage of the evergreen was not significantly different for any of the elements from that of the deciduous species. Foliage of the bog species was lower in content of N and P than the foliage of plants of other habitats and reflects the paucity of available N and P in the bog substrate. Broad-leaved evergreen leaves of bog plants appear to manufacture more photosynthate per acquired unit of N and P than do deciduous leaves, primarily because of their longevity. The high occurrence of evergreenness in infertile environments may therefore reflect a decreased need to acquire N and P from a substrate deficient in these elements. Mn and Al contents were comparable in the bog plants to plants of other habitats, despite potentially toxic levels of these elements in acid bogs. Apparently many bog plants selectively exclude Mn and Al. (Hinkel-Mass)
W80-01919

RESPONSE OF WATER SEDGE IN THE GROWTH ROOM TO FERTILIZER AND TEMPERATURE TREATMENTS,
Department of Agriculture, Kamloops (British Columbia). Research Station.
W. L. Pringle, and A. L. Van Ryswyk.
Canadian Journal of Plant Science, Vol 45, No 1, p 60-66, January, 1965. 1 Fig, 4 Tab, 10 Ref.

Descriptors: *Fertilizers, *Temperature, *Growth chamber, *Water sedges, Bogs, Wet meadows, Wetlands, Soil, Peat, Soil nutrients.

Water sedge (Carex aquatalis Wahl.), the main component of wet bogs, used for hay in central British Columbia responds under growth-room conditions to a complete fertilizer. Potted sedge-sod plugs were grown for five consecutive cuts (242 days) at temperatures of 70 degrees and 40 degrees F and at light intensities less than 1000 ft/c. Reducing the root temperature from 70 degrees to 40 degrees F, which simulated field conditions, lowered the average yield of all treatments by 45%. Phosphorus appeared to be the most limiting element at both temperatures. Nitrogen gave significant increases only at the lower temperature. The addition of soil nutrients more than doubled the recovery of the same nutrients in the forage from plants grown at both 40 degrees and 70 degrees F as compared with controls. On forage not supplied with P, the Ca/P ratio exceeded 3. (Hinkel-Mass)
W80-01926

2L. Estuaries

REMARKABLE YIELD OF BROWN TROUT (SALMO TRUTTA L.) IN LAKES NEAR THE HARDANGER GLACIER, NORWAY,
Trondheim Univ. (Norway). Museum.
For primary bibliographic entry see Field 5C.
W80-01774

VERTICAL DISTRIBUTION OF FISHES IN ONE LAKE DEEP (LAKE KUUSVESI, CENTRAL FINLAND),
Jyvaskyla Univ. (Finland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W80-01777

POPULATION STUDIES OF VENDACE (COREGONUS ALBULA (L.) AND PERCH (PERCA FLUVIATILIS L.) IN A MESOHUMIC OLIGOTROPHIC LAKE,
Joensuu Univ. (Finland). Karelian Inst.
For primary bibliographic entry see Field 5C.
W80-01779

GENETIC DIFFERENTIATION BETWEEN VENDACE (CORRGONUS ALBULA (L.)) POPULATIONS IN EASTERN FINLAND,
Joensuu Univ., (Finland). Karelian Inst.
For primary bibliographic entry see Field 8I.
W80-01793

THE PERFORMANCE OF A WAVE GAUGE IN BUBBLY WATER--WHAT DOES IT MEASURE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
J. B. Hansen.
In: Progress Report No 48, p 3-8, April 1979. 4 Fig, 1 Tab, 1 Ref.

Descriptors: *Waves(Water), *Laboratory tests, *Measurement, *Instrumentation, Analysis, Conductivity, Gages, Air entrainment, Water levels, Wave gage, Conductivity wave gage, Breaking waves.

The profile of a foaming wave can sometimes be determined from photos, but when conductivity (or resistance) type wave gages are used for measuring the surface elevations, the influence of the entrained air on the wave gage output must be analyzed further in order to determine precisely what is being recorded. Detailed investigation of the wave gage performance was carried out in a vessel with controlled air entrainment. The investigation showed that a conductivity wave gage used in bubbly water will indicate a surface elevation that lies between the actual surface (with air included) and the surface that would have existed if no air had been present (height of solid water). The wave gage will exaggerate the height of the column of solid water by approximately 20% of the increment in height due to the air present. By inspection of photos of the front of breaking waves, the air content of the most air entrained parts of the laboratory waves is only 2-4% by volume. For laboratory measurements of breaking waves, this means, in general, that measurements yield solid water wave heights exaggerated by less than 1%. (Humphreys-ISWS)
W80-01809

SEASONAL PATTERNS OF ONSHORE/OFFSHORE SEDIMENT MOVEMENT,
Woods Hole Oceanographic Institution, MA.
D. G. Aubrey.
Journal of Geophysical Research, Vol 84, No C10, p 6347-6354, October 20, 1979. 10 Fig, 3 Tab, 11 Ref.

Descriptors: *Sediment transport, *Beaches, *Beach erosion, *California, Seasonal, Erosion, Sedimentation, Shores, Coasts, Waves(Water), Ocean waves, Profiles, Sands, On-site investigations, On-site data collections, Model studies, Mathematical models, Analytical techniques, Eigenfunctions.

Measurements of beach profiles from southern California spanning a 5-year period have been examined for temporal changes in beach configuration. On an annual time scale, the data suggested two distinct seasonal pivotal points separating eroding and accreting regions. Empirical eigenfunction analysis of combined onshore and offshore profiles showed a pivotal point for seasonal onshore/offshore sediment movement at a depth of 2-3 m below mean sea level and suggested another at a 6-m depth. Analysis of accurate reference rod measurements at 4-, 6-, 10-, 14-, and 20-m depths supported the presence of the 6-m pivotal point. A simple model of depth-dependent seasonal sand movement suggested that during initial winter storms, sand is eroded from both the foreshore and from depths of 6-10 m and is deposited in water depths from 2 to 6 m. During less energetic periods, sediment migrates both shoreward (to the beach face) and seaward (to depths of 10 m) from its winter site of deposition (water depths from 2-6 m). This observation of depth-dependent motion contradicts the simple single pivotal point model previously suggested for nearshore seasonal onshore/offshore sediment motion and emphasizes the complexity of nearshore sediment transport. A sediment budget for seasonal onshore/offshore transport, based on the dual pivotal point model, consists of exchanges of 85 cu m/m of beach length across the 3-m pivotal point and 15 cu m/m across the 6-m pivotal point. Over a longer time scale (i.e., the entire 5 years of study), the beaches showed no net erosion or accretion, suggesting that this limited coastal region is stable over these short time scales. (Sims-ISWS)
W80-01832

EDGE WAVES ON COMPLEX BEACH PROFILES,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
R. A. Holman, and A. J. Bowen.
Journal of Geophysical Research, Vol 84, No C10, p 6339-6346, October 20, 1979. 8 Fig, 1 Tab, 18 Ref.

Descriptors: *Beaches, *Waves(Water), *Tides, *Model studies, Mathematical models, Geomorphology, Beach erosion, Coasts, Ocean waves, Topography, Sands, Profiles, Slopes, Beach profiles, Edge waves.

In order to interpret field data in terms of edge wave modes, investigators usually assume that the beach profile is linear, allowing the use of simple analytical solutions for edge wave structure and wavelength. The validity of this assumption was checked by using a numerical model to find the edge wave modes on a typical concave beach. Results showed that estimates of edge wave wavelength using the plane beach assumption can be wrong by + or - 100% at a fixed mean sea level with a further error of + or - 50% introduced by the tides. Greatly improved estimates can be made if the value of beach slope is chosen to reflect suitably the offshore extent of the edge wave. A rule of thumb for calculating the effective beach slope Beta sub e is Beta sub e = h(x')/x', x' = 1/11(2n + 1)L, where h is the water depth at distance x' from shore, L is the edge wave wavelength, and n is the edge wave mode number. The motion of the offshore profile of the edge wave due to a change of tidal elevation is dramatically different on a concave beach than on a plane beach. The tendency for the profile to move offshore for a drop in tide is compensated by the decrease in mean beach slope and hence reduction in wavelength and offshore extent of the wave. For a fixed instrument, a drop in tide may lead to a profile shift onshore or offshore or no shift at all. Edge wave damping on a concave beach was shown to change as a function of tide. At low tide the surf zone width is increased, while edge wave wavelength is decreased, both factors increasing damping. Thus, edge wave spectra taken at low tide may be less energetic than those at high tide, particularly at high frequencies. (Sims-ISWS)
W80-01834

APPLICATION OF FORMALDOXIME COLORIMETRIC METHOD FOR THE DETERMINATION OF MANGANESE IN THE PORE WATER OF ANOXIC ESTUARINE SEDIMENTS,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
P. B. Armstrong, W. B. Lyons, and H. E. Gaudette.
Estuaries, Vol 2, No 3, p 198-201, September 1979. 2 Fig, 2 Tab, 25 Ref. NSF OCE-77-20484, SG 04-8-MOI-79.

Descriptors: *Sediments, *Estuaries, *Pore water, *Manganese, Analytical techniques, Methodology, Chemical analysis, Colorimetry, Sampling, Coasts, Bays, Chemicals, Iron, Chemistry, *Great Bay(NH), Formaldoxime.

The formaldoxime colorimetric method for manganese, previously utilized for freshwater and seawater samples of large volume, was modified for the analysis of small volume, iron-rich sediment pore water samples. Using as little as 3 ml of sample and the addition of EDTA to destroy the Fe-formaldoxime interference (at concentrations of 9 micro-M Mn/1), a precision of 3% was obtained. (Sims-ISWS)
W80-01841

HYPERSALINE BOTTOM WATER: PEARD BAY, ALASKA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
W. J. Wiseman, Jr.
Estuaries, Vol. 2, No. 3, p 189-193, September 1979. 2 Fig, 16 Ref.

Descriptors: *Bays, *Alaska, *Coasts, *Saline water, Sampling, Surveys, Salinity, Temperature, Water temperature, Hypolimnion, Permafrost, Cold regions, Estuaries, *Peard Bay(AK), Hypersaline waters.

Hypersaline bottom conditions have been observed in Peard Bay, Alaska. The water appears to be renewed on an annual basis. Although it does not seem to affect permafrost degradation rates in Peard Bay, similar pools of water along the Beaufort Sea coast could greatly increase the rates of permafrost degradation. Order of magnitude estimates suggest that the hypersaline waters do not become anoxic. (Sims-ISWS)
W80-01842

LIGHT SCATTERING AND EXTINCTION IN A HIGHLY TURBID COASTAL INLET,
Harbor Branch Foundation, Inc., Fort Pierce, FL. Remote Sensing Services.
For primary bibliographic entry see Field 7B.
W80-01843

TIDAL CURRENTS MEASURED NEAR A BRITISH COASTAL POWER STATION,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research

Labs.
J. F. Macqueen, and G. C. C. Parker.
Advances in Water Resources, Vol 2, No 3, p 113-122, September 1979. 5 Fig, 7 Tab, 16 Ref.

Descriptors: *Currents(Water), *Tidal waters, *Coasts, *Powerplants, Water temperature, Cooling water, Thermal polluion, Ocean currents, Circlation, Ocean circulation, Water circulation, Variability, Tides, Data processing, Mathematical models, On-site investigations, On-site data collections.

During the later half of 1975, the Central Electricity Generating Board (CEGB) commissioned a survey of water temperatures and currents in the sea near Sizewell Power Station, which is located on the coast of the southern North Sea some 150 km north-east of London. The survey was performed in coastal waters up to 5 km offshore and spanning an area of about 50 sq km to assist in an estimation of the marine dispersion of heat released with the cooling water discharge from the power station. This paper was larely concerned with varioations in time and space of the residual tidal movements which provide the mechanism for bulk transport of water and, therefore, of heat or other contaminanats, from the area. It was shown that these variations can be considerable and this has important implications for far-field models of cooling water discharges. The results of harmonic analysis of the tidal velocity were used in two ways; first, the variation of the current with depth was discussed, and the implications of the mid-field mixing of cooling water were brought out. Second, the significance of reflections from the coast was highlighted by splitting the tidal wave into progressive and standing components. (Sims-ISWS)
W80-01850

ASSESSMENT OF AN AMPEROMETRIC MEMBRANE PROBE FOR DETERMINING FREE RESIDUAL CHLORINE IN SALINE COOLING WATERS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 7B.
W80-01867

TIDAL ENERGY AND SUBLITTORAL MACROBENTHIC ANIMALS IN ESTUARIES,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
D. J. Wildish, and D. D. Kristmanson.
Journal of the Fisheries Research Board of Canada, Vol 36, No 10, p 1197-1206, October 1979. 4 Fig, 9 Tab, 29 Ref.

Descriptors: *Estuaries, *Benthos, *Tidal effects, *Organic matter, Chemical analysis, Water sampling, Currents(Water), Tidal energy, Theoretical analysis, Aquatic animals, Littoral, On-site investigations, Testing procedures, Seston, Sediments, Erosion, Aquatic productivity, Water properties, *Bay of Fundy, Adenosine triphosphate.

A quantitative hypothesis was presented that current velocity and roughness at the sediment-water interface control the numbers, biomass, and growth of suspension-feeding macrobenthic animals. The controls are the effect of tidal currents on turbulent mass transfer of food to suspension-feeding animals and direct inhibition of growth and settlement by currents in excess of 12-30 cm/s. The rate of turbulent supply of Adenosine Triphosphate (ATP) associated with seston was proposed as a practical way of determining growth potentials of suspension-feeding macrobenthos at current velocities less than 30 cm/s. (Humphreys-ISWS)
W80-01868

SEICHE EXCITATION IN PORT SAN JUAN, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Oceanography.
D. D. Lemon, P. H. LeBlond, and T. R. Osborn.
Journal of the Fisheries Research Board of Canada, Vol 36, No 10, p 1223-1227, October 1979. 4 Fig, 1 Tab, 13 Ref.

Descriptors: *Seiches, *Harbors, *Waves(Water), *Mathematical models, Frequency, Water levels, Fluctuations, Analysis, Analytical techniques, Surges, On-site investigations, Theoretical analysis, Time series analysis, Tidal waters, *British Columbia, *San Juan Harbour.

Seiche motions observed in San Juan Harbour with a bottom-mounted pressure gage were Fourier-analyzed and interpreted in terms of a theoretical model of oscillations in a rectangular basin with an exponential depth profile. Two of the observed periods (at 14.6 and 38.5 min) were identified with resonances of the basin; two other significant low frequency peaks (at 21 and 55 min) do not coincide with resonant periods of the basin and must be due to strong external forcing. Higher fequency fluctuations (20-160 s) are attributed to swell and to its subharmonic interactions with edge waves. (Humphreys-ISWS)
W80-01869

TERRIGENOUS ORGANIC MATTER IN SEDIMENTS OF THE ST. LAWRENCE ESTUARY AND THE SAGUENAY FJORD,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanography Lab.
R. Pocklington, and J. D. Leonard.
Journal of the Fisheries Research Board of Canada, Vol 36, No 10, p 1250-1255, October 1979. 2 Fig, 2 Tab, 40 Ref.

Descriptors: *Estuaries, *Sediments, *Organic matter, *On-site investigations, Gulfs, Organic compounds, Chemical analysis, Methodology, Carbon, Nitrogen, Sands, Lignins, Mud, *St. Lawrence Estuary, *Saguenay Fjord, Pelites.

The purpose of this study was to interpret chemical analyses of surficial sediments in the St. Lawrence Estuary and the Saguenay Fjord in terms of the contribution of land-derived organic matter to the sediments. A set of over 200 samples, representative of all regions within the Gulf of St. Lawrence, shows organic carbon and nitrogen in the surface sediments to be lognormally distributed. Organic matter is related to sediment texture. Of the two major classes of sediment in the Gulf, pelites (muds) have a significantly higher and less variable organic carbon and nitrogen concentration than sands. Pelites in the Saguenay and Humber fjords have higher and more variable organic carbon content than pelites elsewhere, but they have lower and more variable nitrogen. The concentration of organic nitrogen is highest in pelites in the Gulf and lowest in sands, particularly those farthest from the ocean. The proportion of land-derived organic matter in sediments of the upper St. Lawrence Estuary is unexpectedly low. In the Saguenay Fjord and the lower estuary, high organic carbon to nitrogen ratios and the presence of lignin indicate a substantial contribution of organic matter from terrestrial sources. The proportion of terrigenous organic matter decreases rapidly thereafter, approaching levels typical of marine sediments in the open Gulf. (Humphreys-ISWS)
W80-01870

TIDAL FLOWS IN SALT MARSH CREEKS,
Cambridge Univ. (England). Dept. of Geography.
T. P. Bayliss-Smith, R. Healey, R. Lailey, T. Spencer, and D. R. Stoddart.
Estuarine and Coastal Marine Science, Vol 9, No 3, p 235-255, September 1979. 11 Fig, 5 Tab, 38 Ref.

Descriptors: *Salt marshes, *Tidal streams, *Tidal effects, *Geomorphology, Tidal marshes, Streams, Tides, Flow, Frequency, On-site investigations, On-site tests, Data collections, Analysis, Foreign research, Velocity, Currents(Water), Marshes, Floods, Methodology, Water levels, Flood stages, *England.

Tidal flows in salt marsh creeks must control both creek morphology and the overall sediment and nutrient budgets of the marsh, but little is known of the magnitude and frequency of such flows. Data were presented in this paper from north Norfolk, England. The data indicated a threefold division of the tidal-flow regime. On Upper marshes the majority of tides are 'below-marsh', and, apart from a small initial pulse of velocity on the flood, they generate only modest flows in creeks. The level of the marsh surface provides a threshold at which, with higher 'marshfull' tides, velocities can increase to reach peaks shortly before and shortly after high tide. These velocity pulses are greater on the ebb than on the flood, but the flood pulse occurs at a higher stage. The even higher but infrequent 'over-marsh' tides, often associated with storm surges, have a substantial flood maximum in both velocity and discharge. It was hypothesized that only these extreme tides might be capable, on upper marshes, of achieving significant erosion and deposition, and that their much higher frequency on lower marshes may account for the observed rapidity of geomorphic change at this earlier stage in salt marsh development. (Humphreys-ISWS)
W80-01882

RESIDUAL FLUXES OF WATER AND SALT AT TWO STATIONS IN THE SEVERN ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
R. J. Uncles, and M. B. Jordan.
Estuarine and Coastal Marine Science, Vol 9, No 3, p 287-302, September 1979. 6 Fig, 2 Tab, 13 Ref.

Descriptors: *Estuaries, *Water circulation, *Tidal waters, *Mathematical models, Salt balance, Water balance, Salinity, Model studies, Foreign research, Currents(Water), Analysis, Analytical techniques, Diffusion, On-site tests, Water properties, On-site data collections, Tidal effects, Flow, *United Kingdom, *Severn Estuary.

Observations of currents and salinity were presented for two stations in the Severn Estuary. The observations extended over 50-h periods at both stations, and the data were analyzed to provide estimates of the residual fluxes of water and salt. Relative to the depth averaged values, the axial residual currents show a seaward flow in the upper layer, and a landward flow in the bottom layer for both stations; the associated salinity profiles show only small differences in salinity between the seabed and the sea-surface (equivalent to 0.1 parts per thousand). The tidally averaged velocity and salinty profiles were used to estimate the effective vertical eddy viscosity and diffusivity which are applicable to residual variables, estimated maximum values being of the order of 50 and 100 cm sq/sec, respectively. The computation of residual fluxes showed that the Stokes drift is an important feature of the physical regime of the Severn Estuary. The residual transport of water is the dominant mechanism for the residual transport of salt, of which the transport effected by tidal pumping is of the same order of magnitude as the salt transport due to freshwater discharges into the estuary; the vertical shear appears to be of secondary importance in the salt balance of the estuary. (Humphreys-ISWS)
W80-01883

TIDAL AND SEASONAL VARIATIONS OF TRACE ELEMENTS IN TWO CORNISH ESTUARIES,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
C. R. Boyden, S. R. Aston, and I. Thornton.
Estuarine and Coastal Marine Science, Vol 9, No 3, p 303-317, September 1979. 3 Fig, 5 Tab, 13 Ref.

Descriptors: *Estuaries, *Tidal effects, *Trace elements, *Water pollution, Metals, Water pollution sources, Arsenic, Copper, Lead, Zinc, Nickel, Cobalt, Cadmium, Manganese, Tidal waters, Foreign research, Pollutants, Bottom sediments, Suspended solids, Dissolved solids, On-site investigations, Sampling, Analytical techniques, Water properties, Salinity, Water temperature, Runoff, *England.

Tidal and seasonal changes in trace element concentrations were studied in solution, suspended particulates, and bottom sediments at locations in two Cornish estuaries. The two estuaries chosen for study represented moderate and severe degrees of contamination by metals including arsenic,

copper, lead, tin, and zinc. Results showed that considerable differences in concentrations and behavior of trace elements occur on a tidal and seasonal basis. These differences have been related to the influences of fresh-water input from mineralized catchments and were discussed in terms of mixing of runoff with saline waters during diurnal and annual cycles. (Humphreys-ISWS)
W80-01884

SEDIMENT HYDROCARBONS NEAR AN OIL RIG,
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.
For primary bibliographic entry see Field 5B.
W80-01885

ESTABLISHMENT AND GROWTH OF SELECTED FRESHWATER AND COASTAL MARSH PLANTS IN RELATION TO CHARACTERISTICS OF DREDGED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
J. W. Barko, R. M. Smart, C. R. Lee, M. C. Landin, and T. C. Sturgis.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-039 495, Price codes: A03 in paper copy, A01 in microfiche. Technical Report D-77-2, March, 1977. 41 p, 36 Ref.

Descriptors: *Marsh plants, *Spoil banks, *Vegetation estabishment, Wetlands, Dredging, Plant growth, Rhizomes, Root systems, Nitrogen, Saline soils, Marshes, Productivity.

An investigation of the success of establishment and growth of marsh plants on physically and chemically different dredged sediments was conducted under semi-controlled conditions in a greenhouse. Growth of freshwater plants was affected by the availability of nitrogen and was significantly greater on fine-textured sediments than on sand. Growth of both brackish and salt marsh plants was relatively unrelated to nutrient availability, and was most affected by the salinty of the sediment solution. Within the same period of growth, transplants produced plant populations having greater biomass and numbers of stems than did any of the other plant propagules. Rhizomes, rootstocks, and tubers responded similarly, but to a lesser extent, to sediment differences than transplant propagules of the same species. (Steiner-Mass)
W80-01910

PHYSIOLOGY OF COASTAL HALOPHYTES,
Chesapeake Research Consortium, College Park, MD.
For primary bibliographic entry see Field 2I.
W80-01918

EFFECTS OF HERBICIDES ON THE SPARTINA SALT MARSH,
Auburn Univ., AL. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 4C.
W80-01920

ECOLOGY AND RESTORATION OF MANGROVE SHORELINES IN FLORIDA,
Miami Univ., Coral Gables, FL. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-01921

SALT MARSH PLANTS AND FUTURE COASTAL SALT MARSHES IN RELATION TO ANIMALS,
Delaware Univ., Newark. Dept. of Biological Sciences.
For primary bibliographic entry see Field 6G.
W80-01923

VASCULAR HALOPHYTES OF THE ATLANTIC AND GULF COASTS OF NORTH AMERICA NORTH OF MEXICO,
Georgia Univ., Athens. Dept. of Botany.
W. H. Duncan.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.), Academic Press, Inc., New York, p 23-50, 1974. 59 Ref.

Descriptors: *Halophytes, *Marsh plants, *Atlantic coastal plain, *Gulf coastal plain, Wetlands, Salt marshes, Marshes, Coastal marshes, Habitats.

Difficulties in deliminting halophytes and halophytic habitats are discussed and an annotated list of halophytes presented. Data included for each species are: the halophytic habitats in which they are reported to occur, the authors reporting the habitats, page citations for these reports, and composites of the coastal geographic distributions compiled from numerous authors. The list of halophytes includes 347 species in 177 genera and 75 families. The possibilities that some species may be erroneously listed and others apparently omitted are discussed. Geographic distributions are analyzed by areas and summarized. The most species, 197, occur in the area from Georgia into Delaware. Thirty-eight occur in Florida, 17 only in Canada, and 32 in every one of the coastal states from Texas into Canada. Habitat terminology lacks uniformity. (Steiner-Mass)
W80-01924

A MODELING APPROACH TO EVALUATE TIDAL WETLANDS,
Gruman Ecosystems Corp., Bethpage, NY.
D. Hill.
In: Transactions 41st North American Wildlife and Natural Resource Conference, March 21-25, 1976, Washington, DC, p 105-117. Wildlife Management Institute, Washington, DC, 1976. 2 Fig, 1 Tab, 14 Ref.

Descriptors: *Salt marsh, *Model studies, *Marsh management, *Eocnomics, *Evaluation, *Income, Wetlands, Mathematical models, Decision making, Costs, Natural resources, Alternative costs, Social values, Cost allocation, Water allocation(Policy).

A resource allocation model of the linear programming type was devised to provide an economic evaluation ofwetlands. Exercise of the model shows the values that are inputed to wetlands by alternative resource management decisions. The model consists of a set of equations that define the biological, physical, chemical, and economic boundaries on the possible uses of a hypothetical bay. With these equations, the combination of uses is determined that maximizes the value of the objective function, the components of which are annual net income (in dollars), the environmental value, and the social value. Finding the maximum dollar value (or, equivalently, the minimum cost) of this complex of uses identifies those that give the salt marsh its greatest monetary value. The annual dollar value of the salt marsh is determined to the extent to which it contributes to net income or reduces the need for costly alternatives. No distinction is made in this model between income that results from using the wetland and that which results from destroying it; the typical year considered is assumed to extend into the indefinite future. (Steiner-Mass)
W80-01927

ZOOPLANKTON DISTRIBUTION IN RELATION TO THE HYDROLOGY OF THE DERWENT RIVER ESTUARY,
Tasmania Univ., Hobart (Australia). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W80-01985

MATHEMATICAL MODELLING OF EUTROPHIED COASTAL AREAS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
For primary bibliographic entry see Field 5C.
W80-01993

WATER CONDITIONS IN THE STOCKHOLM ARCHIPELAGO AFTER THE INTRODUCTION OF BIOLOGICAL AND CHEMICAL PURIFICATION OF WASTE WATER.
Stockholm Water and Sewerage Works (Sweden).
For primary bibliographic entry see Field 5C.
W80-01994

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PROCESS FOR DE-SALTING OF WATER AND APPARATUS FOR PERFORMING THIS PROCESS,
G. Mach.
U.S. Patent No 4,167,480, 5 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 986, No 2, p 411-412, September 11, 1979.

Descriptors: *Patents, *Desalination, *Demineralization, Reverse osmosis, Semipermeable membranes, Membrane processes, Magnetic fields.

A process is described for desalting water by passing a stream of water to be desalted to a reverse osmosis system having a high pressure chamber which receives the stream of water to be desalted and which discharges a stream of water enriched in salt and having semipermeable membrane means through which essentially desalted water passes from the high pressure chamber to a desalted water chamber. Prior to is passage through the semipermeable membrane means, the stream of water is passed through at least one magnetic field so that clogging of the pores of the semipermeable membrane is reduced. The arrangement can be such that magnets are applied to the outer side of the supply conduit and are applied at diametrically opposed areas of this conduit. This provides the advantage that the magnetic field is mainly crossing at a right angle the path of flow of the water to be desalted. (Sinha-OEIS)
W80-01951

3B. Water Yield Improvement

CRITICAL APPRAISAL OF WORK DONE ON WATER HARVESTING SYSTEMS,
Udaipur Univ. (India). Coll. of Technology and Agricultural Engineering,
M. T. Deshmukh.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8 Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC., p 256-265, 1979. 2 Tab, 26 Ref.

Descriptors: *Water harvesting, *Water yield improvement, *Water storage, Watersheds(Basins), Design, Runoff, Rainfall, Foreign research, Water utilization, *India.

Work done on water harvesting was critically appraised, taking into consideration various aspects of a system such as (1) water harvesting concepts, (2) water harvesting catchments, (3) runoff storage structures, (4) types of storage, (5) location of storage, (6) economic water storage, (7) design of the system, and (8) utilization of harvested water. Based on the appraisal of the work, tables were prepared and tabulated for Udaipur region of Rajasthan, India, for selecting suitable size of catchment and storage. (Humphreys-ISWS)
W80-01803

3D. Conservation In Domestic and Municipal Use

WATER-FLOW CONTROL DEVICE,
T. L. Merritt.
U.S. Patent No 4,161,965, 4 p, 5 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 4, p 854, July 24, 1979.

Descriptors: *Patents, *Water conservation, *Control, Flow control, Domestic water, Equipment, Shower heads.

A water-flow control device for shower heads is adapted to be positioned within the shower supply pipe adjacent the shower head so that the water-flow rate is considerably reduced and the varying pressure flow is automaticaly compensated. The device is comprised of a unitary body of resilient material having a central longitudinal bore to permit passage of water. The receiving end of the body is formed with a pair of oppositely inclined walls having a slot defining movable shoulders which are inwardly flexed under high-flow conditions thereby restricting water flow through the central bore. (Sinha-OEIS)
W80-01949

3F. Conservation In Agriculture

A MULTI-DISCIPLINARY APPROACH TO THE RECLAMATION OF IRRIGATION SCHEMES IN CENTRAL IRAQ,
Food and Agriculture Organization of the United Nations, New York.
J. G. Pike, and A. K. Mitra.
Journal of the Institution of Water Engineers and Scientists, Vol 31, No 3, p 175-186, May 1977. 2 Fig, 7 Ref.

Descriptors: *Irrigation, *Reclamation, *Central Iraq, *Multidisciplinary approach, *Project planning, Agriculture, Topography, Drainage, Climate soils, Water resources, Design, Management surveys, Linear programming, Optimization, Cropping patterns, Benefit maximization, Investment, Water utilization, Farming systems, Systems analysis, Feasibility.

Iraq needs to improve agricultural production to feed a growing population. Land deterioration in the central alluvial plain necessitates carefully planned large-scale reclamation schemes, calling for an integrated multidisciplinary approach to investigate problems imposed by the existing irrigation and farming system and by the adverse natural conditions, all of which limit the choice of alternatives and options. Discussed herein are: (1) irrigation in Central Iraq; (2) the Greater Mussayib Project, its topography, soils, climate, water resources, irrigation and drainage system, and irrigated farming system; (3) project investigations, including objectives, a farm management survey, and optimum farming systems and cropping patterns by linear programming; (4) development proposals, considering irrigation and drainage, farm development and infrastructure; and (5) investment feasibility. It is concluded that project studies need to assess the existing farming system's resources and ability to bring about changes. The core of the investigation is to mount a farm management survey at an early stage, from which technical data, farming systems, and benefit-maximized cropping patterns and water requirements may be determined. This would yield criteria for redesigning the irrigation and drainage network, infrastructure and institutions. (Bell-Graf--Cornell)
W80-01695

CONSERVING SUPPLEMENTAL IRRIGATION WATER APPLIED TO SOYBEANS,
Mississippi State Univ., Mississippi State. Dept. of Agronomy.
F. D. Whisler, and H. F. Hodges.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119936, Price codes: A03 in paper copy, A01 in microfiche. Report, October 1979. 28 p, 16 Tab, 12 Ref. OWRT A-121-MISS (1), 14-34-0001-9026.

Descriptors: *Growth stages, *Moisture stress, *Soil-water-plant relationships, *Soybeans, *Supplemental irrigation, *Timing, *Water management(Applied), Crop production, Environmental effects, Irrigation effects, Irrigation practices, Moisture uptake, Nuclear moisture meters, Plant growth, Tensiometers, Transpiration, Water donservation, *Leaf diffusive resistance, *Plant water potential, *Soil water potential, 100 seed weight.

In order to conserve or use most wisely agricultural water supplies as supplemental irrigation to natural rainfall, knowledge of when to irrigate, how much to irrigate and what are the plants' responses to water stress are needed. Studies to answer parts or all of these questions for soybeans were conducted in 1978 and 1979 at the Blackbelt Experiment Station near Brooksville, Mississippi and at the Plant Science Farm at Starkville, Mississippi. Field plots at the Blackbelt Station were covered with plastic with trickle irrigation beneath the plastic to control the soil moisture on some of the stressed plots. Large (76 1) containers were used at the Plant Science Farm to control a high water table condition. Plastic covers and irrigation beneath the plactic was used on some containers to induce stress when desired. The plants' most critical period of water requirement was during the pod filling stage. The amount of water needed as supplemental irrigation varied with the year and location. The water usage during pod filling was 2 to 8 times more in a dry year like 1978 compared to a wet year like 1979. Stressed plants tended to close their stomata and thereby increase their leaf diffusive resistance. This reduced their sensitivity to environmental variables and evaporative demands. Nonstressed plants were much more sensitive to environmental variables such as soil water content and solar radiation.
W80-01796

NONPOINT SOURCE POLLUTION CONTROL BY SOIL AND WATER CONSERVATION PRACTICES,
Cornell Univ., Itahca, NY. Dept. of Agriculture Engineering.
For primary bibliographic entry see Field 2E.
W80-01892

STATUS OF PRESENT PEATLAND USES FOR AGRICULTURAL AND HORTICULTURAL PEAT PRODUCTION,
Minnesota Univ., Minneapolis. Dept. of Soil Science.
For primary bibliographic entry see Field 2H.
W80-01929

MOBILE PIVOT TOWER FOR IRRIGATION SYSTEM,
Rainmatic International Ltd., Honolulu, HI. (Assignee).
K. J. Hegemann.
U.S. Patent No 4,163,459, 6 p, 4 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 65, August 7, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Application equipment, Irrigation practices, Irrigation efficiency, Pivot towers.

A center pivot irrigation system comprises mobile towers spaced apart and aligned in a row with an irrigation pipe extending between them and suported on the towers. The row of a aligned towers pivots about a mobile pivot tower located at the water supply. The mobile pivot tower comprises a vertically disposed frame mounted on a pair of wheels. The frame and one wheel are mounted to pivot about the other wheel, and anchoring structure restrains the other wheel from moving during pivoting of the frame and one wheel. (Sinha-OEIS)
W80-01940

DRIP IRRIGATION APPARATUS,
W. Meckel.
U.S. Patent No. 4,166,580 4 p, 4 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 986, No 1, p 105, September 4, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation practices, Irigation efficiency, Flow control, Drip irrigation.

A drip-forming device for drip irrigation apparatus comprises a tube having a smooth internal surface and a a smooth surfaced rod having one end inserted into the tube by an adjustable amount. The rod is formed with a least one longitudinal groove which extends along its length and which is in communication with the part of the interior of the tube not occupied by the rod and whose depth decreases progressively away from the one end over at least part of the length of the groove. With such devices, the output of each device can be simply adjusted to suit the local requirements, irrespective of the size, alignment and supply pressure of the complete irrigation apparatus, by adjustment of the depth of insertion of the rod in the tube. For a constant pressure the water output decreases with increasing depth of rod insertion--i.e., as the minimum cross-section of the groove at the point of insertion of the rod in the tube decreases. At different pressure depending, for example, on gradient, the water output from different devices can be made equal by varying the depth of insertion of the rods in the tubes appropriately. (Sinha-OEIS)
W80-01974

LOCK VALVE FOR SPRINKLER,
Safe-T-Lawn, Inc., Hialeah, FL. (Assignee).
R. J. Harrison.
U.S. Patent No. 4,166,576, 4 p, 3 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 986, No 1, p 104, September 4, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, Sprinkler irrigation, Flow control, Water measurement, Flow measurement, Irrigation efficiency.

This invention relates to the field of irrigation devices which are easily connectable to a water line to allow water to be metered out of the line at a given specified rate. To use the device, the bubble is connected to an input pipe, the valve is adjusted and then the wedge shaped protuberance is broken away from the body portion at the border area. When the water is turned on it flows through the body. The water then flows between the upper surface of the cylindrical body and the bottom surface of the cover until it escapes via the nozzles in the cover. Since the body and cover are adjustably connected via a screw the distance between the two components may be adjusted and hence the flow of water can be adjusted by simply turning the cover. When the desired flow rate is achieved, the wedged shaped object previously broken off from the body is forced into the wedging cavity between the body and the cover thus locking the cover and body into a fixed position relative to one another. (Sinha - OEIS)
W80-01987

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

SLOW SAND FILTERS FOR THE LEYTE METROPOLITAN WATER DISTRICT,
Trans-Asia, Manila (Philippines).
E. S. Salvo.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani & N. C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 415-420, 1978. 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Sand filters, *Metropolitan water districts, *Water supply, *The Philippines, Water demand, Water resources development, Planning, Pipes, Head loss, Hydraulics, Population forecast, Developing countries.

The Leyte Metropolitan Water District comprises the city of Tacloban and the municipalities of Palo, Tanauan, Pastrana and Dagami. The most advantageous source of water is located high up in the mountains but because of the high cost of construction to the site, a new source on the same river was selected. The new source is lower in elevation by 85 meters but substantially inhabited. An infiltration gallery utilizing the principles of slow sand filters was designed. Two layers of sand and well-graded gravel formed the filter media. Slotted po-

lyvinyl chloride pipes formed the underdrains. (Bell-Graf--Cornell)
W80-01648

LEVEL-B MULDUAL-PURPOSE DETENTION BASINS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr.
Journal of the Water Resources Planning and Management Division, Proceedings of the American society of Civil Engineers, Vol 105, No WR2, September 1979, p 403-412. 3 Fig, 32 Ref.

Descriptors: *Urbanization, *Dams, *Multiple-purpose projects, *Runoff, *Streams, *Flood control, *Water quality, Design, Detention reservoirs, Environmental effects, Land use, Regulations, Water pollution, Urban development.

Design criteria for small detention basins, which are being built in large numbers to reduce flooding in rapidly urbanizing areas, may be modified to serve additionally the purpose of reducing runoff pollution, which also accompanies urbanization. Only slight reduction in local flood-control effectiveness will be entailed by the modification, and the dual-purpose basins will be more useful in aid of flood control further downstream than the single purpose locally-oriented structures. Runoff pollution from urbanizing areas is important to water-quality planning, and occurs largely in particulate form. However, the trap effectiveness of detention basins for different kinds of pollutant, retained in storage for various periods, has not yet been determined by research or practical experience, so that design criteria for dual-purpose detention basins cannot be stated with any degree of precision. (Bell-Graf--Cornell)
W80-01679

CHICAGO WATER SYSTEM: OPPORTUNITIES AND CHALLENGES OF LAKE MICHIGAN,
Chicago Dept. of Water and Sewers, IL.
R. A. Pavia.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR2, p371-375, September 1979.

Descriptors: *Water distribution(Applied), *Water supply, *Water treatment, *Treatment facilities, *Chicago(IL), *Water shortage, Diversion, Water purification, Water services, Lake Michigan.

As regions and localities all over the world are being faced with the growing problem of water shortages, Chicago is fortunate to have Lake Michigan, an excellent source of supply that can be readily treated to a high-quality finished product. Chicago's vast water system presently serves a population of approximately 4,600,000 people in Chicago and 74 neighboring suburban communities and operates the world's two largest water purification plants. Eleven pumping stations located throughout the City pump over 374.7 billion gallons (1,423,860,000sq m) of water a year. The system comprises 4,160 miles (6,697.6km) of water mains and 65 miles (104.65km) of water supply tunnels. Water intake cribs constructed off the shores of Lake Michigan supply the purification plants with raw water for processing. (Bell-Graf--Cornell)
W80-01681

WATER SUPPLY REGIONALIZATION: A CRITICAL EVALUATION,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
R. M. Clark.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR2, p 279-294, September 1979. 3 Fig, 6 Tab, 9 Equ, 10 Ref.

Descriptors: *Water distribution(Applied), *Water supply, *Regional planning, *Potable water, *Evaluation, *Federal laws, Urban planning, Utilities, Water quality, Costs, Economic analysis, Systems engineering, Drinking water, Regional water systems, Technology, Human population, Scale effects, Water treatment, Support services.

The Safe Drinking WAter Act will cause a careful examination of the way water is handled before it is delivered to the consumer. A part of the 'Act' explicitly encourages development of regional water supplies. Federal policy makers tend to interpret regionalization as meaning a centralized system with one single large-scale plant. There is nothing inherently wrong with this approach and there is some evidence that larger supplies provide high quality water. These 'quality' and economies of scale arguments are examined and evidence is provided that there are limits to the efficient size of water supply systems. Given these limits, the issue to be considered is one of decentralized plants serving one regional authority versus independent systems. The efficiency of a regional authority might be maintained at the expense of losing individual political autonomy. (Bell-Graf--Cornell)
W80-01684

FLOOD INSURANCE PROGRAM: REGIONAL AGENCY'S PERSPECTIVE,
Donohue and Associates, Inc., Waukesha, WI.
S. G. Walesh.
Journal of the Water Resources Planning and Management Division, Proceedings of the Amrican society of Civil Engineers, Vol 105, No WR2, September 1979, p 243-257. 20 Ref.

Descriptors: *Flood control, *Urban planning, *Insurance, *Regulations, *Flood plains, Water resources, Urban development, Floods, Land use, Management, Programs, Watersheds(Basins).

While the National Flood Insurance Program (NFIP) has enhanced flood plain management on the national level, some aspects of the program have frustrated flood plain management efforts within state and local governmental jurisdiction. Positive features of the NFIP as seen from the perspective of a regional planning agency experienced in flood plain management are: mandatory flood plain regulations and certainty of post-flood financial assistance. Negative features of the NFIP are: problems associated with the required floodway delineations, the civil division orientation, use of existing condition flood hazard data for regulatory purposes, and the limited scope with respect to finding solutions to existing and future flood problems. The effectiveness of the NFIP could be enhanced by: conducting studies on a watershed basis, encouraging comprehensive land use planning and control in riverine areas, analyzing upstream and downstream impacts of floodways, determining the impact of future land uses, and encouraging the use of flood insurance studies as the first phase of comprehensive watershed studies. (Bell-Graf--Cornell)
W80-01686

WATER: A PERSPECTIVE ON GLOBAL ISSUES AND POLITICS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
A. K. Biswas.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR2, p 205-222, September 1979. 6 Tab, 9 Ref.

Descriptors: *Water management(Applied), *Water policy, *Water supply, *Industrial water, *Diseases, *Social impact, *International waters, *Water utilization, Water demand, Rural areas, Urban areas, Water balance, Environmental effects, Environmental impact statements, Agriculture, Efficiencies, Hydroelectric power generation, Political aspects.

The uneven distribution of water in the world is reviewed. Development of water quality problems is traced. The policy options for sectoral uses, especially in terms of rural and urban water supply, agriculture, industry, and hydroelectric power are outlined. The present status of water development in these four sectors is provided on a regional basis for the whole world, and in certain cases national information is also given. Lack of water development in developing countries is emphasized, and possible investment costs are indicated. Social and environmental impacts of water development projects are discussed in detail under three categories of sub-systems: physical, biological and human. It is concluded that the major problem is not one of the Malthusian specter of impending scarcity but one of instituting more rational management practices. (Bell-Graf--Cornell)
W80-01688

OPTIMAL CAPACITY OF MUNICIPAL WATER SUPPLY PUMPS,
Utah Water Research Lab., Logan.
T. C. Hughes.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR2, p 317-328, September 1979. 7 Fig, 1 Tab, 4 Ref.

Descriptors: *Water supply, *Power, *Pumping, *Rate, *Municipal engineering, *Economic analysis, *Costs, Design, Electrictiy, Planning, Economis of scale, Demand.

Capital costs of pumping equipment include economies of scale; however, such costs are now dominated by diseconomies of scale related to operating costs. The diseconomies are produced by the demand charge component of electrical power costs. A conclusion is that special emphasis should be placed upon analyzing the potential savings due to matching pump capacity as closely as practicable with peak period demands in order to increase pump use factors, thereby lowering unit pumping costs. Power cost rate schedules in current use for municipal pumping in three states are presented in dimensionless form. A sample analysis of the potential savings due to short-term planning horizons for pump capacities is presented. (Bell-Graf--Cornell)
W80-01691

THE ANALYSIS OF LARGE, COMPLEX WATER NETWORKS WITH SMALL COMPUTER SYSTEMS,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
E. R. Dodge, H. R. Hoellein, and L. Tetmajer.
Journal of the American Water Works Association, Vol 70, No 7, p 366-370, July 1978. 6 Fig, 14 Equ, 12 Ref, 1 Append.

Descriptors: *Water distribution(Applied), *Networks, *Computer programs, *Newton-Raphson approximations, Water supply, Pumps, Pipes, Equations, Systems analysis, Municipal water systems.

Computer analysis of large and complicated water distribution systems need not require correspondingly large computers if disc pack is available. A program is described herein which solves networks of up to 1000 nodes using computer memory of 35 K works and disc capability. Many engineering students are still using the Hardy Cross methods introduced over 40 years ago. Among the more promising alternatives, however, is the nodal formulation of the matrix equation using the Newton-Rhapson first-order approximations to the nonlinear equations that express rate of change of unbalanced flow at each node with respect to change of head at all connected nodes, including node under consideration. The program outlined herein, written in Fortran IV, G level language, uses this method to solve large-scale networks with supply pumps taking water from wells or reservoirs, booster pumps, pressure-actuated check valves, one-way check valves, pressure-regulating valves, reservoirs of any geometric shape, fire flows superposed on other nodal demands, and sprinkler heads at nodes for golf-course, agricultural, or building fire sprinkler applications. (Bell-Graf--Cornell)
W80-01697

BENTHOS TYPOLOGY OF SPANISH RESERVOIRS,

Barcelona Univ., (Spain). Dept. of Ecologia.
For primary bibliographic entry see Field 5C.
W80-01723

FACTORS GOVERNING TURBIDITY IN A SOUTH AFRICAN RESERVOIR,
For primary bibliographic entry see Field 5C.
W80-01724

MAN-MADE STRESS PATTERNS IN TWO IMPOUNDMENTS,
Orange Free State Univ., Bloemfontain (South Africa). Inst. of Environmental Science.
For primary bibliographic entry see Field 5C.
W80-01725

EFFECTS OF IMPOUNDMENTS ON RIVERS: AN AUSTRALIAN CASE STUDY,
Adelaide Univ., (Australia). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W80-01726

STABILITY OF DIURNAL STRATIFICATION IN THE FORMING BROKOPONDO RESERVOIR IN SURINAME, SOUTH AMERICA,
Vrije Univ., Amsterdam (Netherlands). Biological Lab.
For primary bibliographic entry see Field 5C.
W80-01727

TEMPERATURE AND OXYGEN STRATIFICATION IN AMERICANA RESERVOIR, STATE OF SAO PAULO, BRAZIL,
Sao Paulo Univ. (Brazil). Dept. of Ecology.
For primary bibliographic entry see Field 5C.
W80-01728

VERTICAL MIGRATION OF DAPHNIA GESSNERI HERBST, 1967, IN AMERICANA RESERVOIR, STATE OF SAO PAULO, BRAZIL,
Sao Paulo Univ. (Brazil). Dept. of Ecology.
For primary bibliographic entry see Field 5C.
W80-01729

IMPOUNDMENTS AND THEIR INFLUENCE ON THE RIVERS STUDIED BY BIOASSAYS,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
For primary bibliographic entry see Field 5C.
W80-01781

RELATIONSHIPS AMONG BIOLOGICAL AND PHYSIOCHEMICAL PARAMETERS IN SPANISH RESERVOIRS,
Instituto de Investigaciones Pesqueras, Barcelona (Spain).
For primary bibliographic entry see Field 5C.
W80-01782

ZOOPLANKTON CRUSTACEANS IN SPANISH RESERVOIRS,
Barcelona Univ. (Spain). Dept of Ecologia.
For primary bibliographic entry see Field 5C.
W80-01783

HISTORICAL AND ECOLOGICAL FACTORS CONCURRING IN THE DISTRIBUTION, BIOMETRY AND FERTILITY OF PLANKTONIC CRUSTACEANS IN PYRENEAN LAKES,
Barcelona Univ. (Spain). Dept. of Ecologia.
For primary bibliographic entry see Field 5C.
W80-01784

COMPOSITION AND DYNAMICS OF ZOOPLANKTON IN THE SAVA LAKE,
Institute for Biological Research, Belgrad (Yugoslavia).
For primary bibliographic entry see Field 5C.
W80-01785

SEDIMENTATION PROCESS ABOVE THE ASWAN HIGH DAM IN LAKE NASSER-NUBIA (EGYPT-SUDAN),
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
For primary bibliographic entry see Field 5C.
W80-01786

OBSERVATIONS ON PHYTOPLANKTON AND PRIMARY PRODUCTIVITY IN VOLTA LAKE, GHANA,
Nigeria Univ., Nsukka.
For primary bibliographic entry see Field 5C.
W80-01787

DIURNAL VERTICAL DISTRIBUTION OF ZOOPLANKTON DURING STRATIFICATION IN KAINJI LAKE, NIGERIA,
Kainji Lake Research Inst. New Bussa (Nigeria).
For primary bibliographic entry see Field 5C.
W80-01788

SPACE-CORRELATION FIELDS OF PAN EVAPORIMETER NETWORK,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2D.
W80-01831

4B. Groundwater Management

DESIGN AND MERIT OF A RIVER-MODEL FOR OPTIMAL USE OF AGRICULTURAL WATER,
Colordo State Univ., Fort Collins. Dept. of Civil Engineering.
H. J. Morel-Seytoux, C. J. Daly, T. Illangasekare, and A. Bazaraa.
In: Water for Survival, Volume I; Proceedings of the Third World Conference on Water Resources (8Vol), Mexico City (Mexico), April 23-27, 1979. International Water Resources Association, Washington, DC., p 276-288, 1979. 5 Fig, 7 Ref. USBR No 7-07-70-X0009, USDA 01CD (Agreement No 58-319R-8-134).

Descriptors: *Conjunctive use, *Model studies, *Agruculture, *Design, Aquifers, Rivers, Water utilization, Analytical techniques, Computer models, Water allocation(Policy), Irrigation, *South Platte River(CO).

A stream-aquifer model was needed to assess the impact of alternate strategies of management for maximum beneficial agricultural use of water. The design of the model was discussed in detail. The design of a model specific to a particular area of the South Platte river basin in eastern Colorado was complex. The complexity resulted from the size of the system, from the need to simulate the system both at an operational time scale (week) and at a long-term planning horizon (10 years), and from the administration of a complicated water rights structure. The model designed was successfully applied to a field problem with a number of inherent complexities arising due to the physical size, the necessity to simulate the system at short time steps for large time horizons, and an administrative system based on water rights. Some of the details discussed under the design procedures are crucial in applying numerical models to real problems. The design procedures discussed in this paper made it possible to apply the model at very moderate cost of $350 for a simulation and still maintain very high accuracies in simulating the physical behavior. (Humphreys-ISWS)
W80-01805

4C. Effects On Water Of Man's Non-Water Activities

THE QUALITY OF GROUNDWATER IN CALIFORNIA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 5B.
W80-01734

EFFECTS OF HERBICIDES ON THE SPARTINA SALT MARSH,
Auburn Univ., AL. Dept. of Botany and Microbiology.
A. C. Edwards, and D. E. Davis.
In: Ecology of Halophytes, Reimold, R. J. and Queen W. H. (eds.), Academic Press, Inc., New York, p 531-545, 1974. 4 Fig, 3 Tab, 25 Ref.

Descriptors: *Herbicides, *Marsh plants, *Salt marshes, Wetlands, Marshes, Halophytes, Arsenicals(Pesticides), Phytotoxicity, Toxicity, Grasses, Pesticides, Pesticide residues.

The literature dealing with the use of herbicides to control Spartina is reviewed with the mode of action, effects on non-target organisms, persistence, and possible effects of these herbicides on the salt marsh being discussed. Preliminary results from experiments conducted on Sapelo Island, Georgia, on the effects of monosodium methanearsonate (MSMA) on Spartina alterniflora and Littorina irrorata are reported. MSMA effects on P32 uptake by Spartina alterniflora are also given. (Steiner-Mass)
W80-01920

4D. Watershed Protection

AGRICULTURAL MANAGEMENT PRACTICES TO EFFECT REDUCTIONS IN RUNOFF AND SEDIMENT PRODUCTION.
Mississippi State Univ., Mississippi State. Dept. of Agronomy.
F. D. Whisler, J. K. Young, M. J. M. Romkens, J. Y. Wang, and N. W. Buehring.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116486, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Mississippi State University Report, October 1979. 47 p, 10 Fig, 19 Tab, 20 Ref. OWRT B-019-MISS (1), 14-34-0001-8094.

Descriptors: *Erosion rates, *Fertilizers, *Nitrates, *Phosphates, *Potash, *Pre-emergents, *Pesticides, *Particle size, *Rainfall-runoff relationships, *Sediment control, *Simulated rainfall, *Soil aggregates, *Soil managment, *Soybeans, Agricultural chemicals, Agricultural runoff, Coarse aggregates, Fine aggregates, Crop production, Hydrographs, Infiltration, Pollution abatement, Water pollution, *Alachlor, *Sedigraphs, *Trifluralin, *Selective adsorption.

This study reports on the soil erosion rates for three commonly occurring soil management systems on bottomland in soybean production, on the nutrient composition of runoff from these systems, on herbicide losses from these systems, on the relationship between sediment particle size and herbicide concentrations and the effect of different soil management systems on sediment particle (aggregate) sizes. A rainfall simulator was used on plots with soybean management systems of disc, chisel and plant (conventional); planting in old soybean stubble (minimum tillage); and broadcast seeding into standing wheat (double cropping). Fallow plots were used to evaluate the management systems effectiveness. Rainfall was applied in the fall of 1977 after soybean harvesting and again in the spring of 1978 after soybean planting. Soil loss was reduced, in order of decreasing effectiveness, by double cropping, minimum tillage, conventional, and fallow. From sediment nutrient chemical analysis the percent of fines or clay increased as the amount of sediment lost by a particular management system decreased. Greatest nutrient losses were associated with the sediment phase of the runoff. Herbicide losses were greatest for the more water soluble herbidides. The herbicides appeared to be selectively adsorbed to either the large sediment particles (probably aggregates >2 mm) or the fine particles (probably silt and clay <0.063 mm).
W80-01607

STUDIES OF TILLAGE-INDUCED EFFECTS ON HYDRAULIC CONDUCTIVITY.
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 2G.
W80-01798

RUNOFF LOSSES OF SURFACE-APPLIED HERBICIDES AS AFFECTED BY WHEEL TRACKS AND INCORPORATION,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. L. Baker, and J. M. Laflen.
Journal of Environmental Quality, Vol 8, No 4, p 602-607, October-December 1979. 4 Fig, 5 Tab, 7 Ref.

Descriptors: *Runoff, *Herbicides, *Sediments, Suspended solids, Soil compaction, Farm management, Water pollution, Water pollution sources, Water pollution control, Pollutants, Path of pollutants, Sampling, On-site investigations, Wheel tracks, Incorporation, Best management practices, Propachlor, Atrazine, Alachlor.

The effects of incorporation and wheel-track compaction on runoff losses of herbicides were determined by measuring losses of propachlor (2-chloro-N-isopropylacetanilide), atrazine ((2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine)), and alachlor ((2-chloro-2', 6'-diethyl-N-(methoxymethyl) acetanilide)) in water and sediment from small plots during 122 mm of simulated rainfall. Losses of propachlor, atrazine, and alachlor that were surface-applied to plots without wheel tracks were 3.0, 4.7, and 8.0%, respectively. Corresponding losses from plots where the herbicides were incorporated by disking were only 0.8, 1.6, and 1.7%. Hydrologic differences (more and sooner runoff) caused by wheel tracks on plots where herbicides were surface-applied increased the corresponding losses to 12.7, 18.3, and 22.1%. Although herbicide concentrations were greater in sediment than in water for all treatments, from 82 to 89% of the losses were in solution. (Sims-ISWS)
W80-01838

SOIL CONSERVATION LIMITATIONS ON REMOVAL OF CROP RESIDUES FOR ENERGY PRODUCTION,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Lab.
For primary bibliographic entry see Field 2J.
W80-01839

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

WATER POLLUTION OF CHI-SHURI RIVER IN TAIWAN,
National Cheng Kung Univ., Tainan (Taiwan). Dept. of Environmental Engineering.
J. F. Kao, C. G. Wen, and S. S. Cheng.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergman Press Inc. in USA), p 125-132, 1978. 3 Fig, 2 Tab, 8 Equ, 5 Ref.

Descriptors: *Water pollution, *Chi-Shui River(Taiwan), *Pollution loading, *Water quality models, Biochemical oxygen demand, Dissolved oxygen, Equations, Industrial wastes, Waste water(Pollution), Pollutants, Paper mills, Estimating, Sugar plants, Systems analysis, Estuaries, Assimilative capacity.

Industrial wastes, domestic sewage and materials flushed by runoff contribute to the major pollutional load of the Chi-Shui River, located in southwest Taiwan. The critical period of pollution occurs during the dry winter season, when industrial wastes produce on average 51 metric tons of BOD/day and a domestic sewage discharge of 2 metric tons of BOD/day. However, the assimilative capacity of this river is estimated at 4.7 metric tons of BOD/day by the empirical model. Anaerobic biodegration occurs over the estuary area because very little dissolved oxygen is utilized to degrade organic pollutants. In addition, noxious residual pollutants cause harmful effects in fishing areas. A study of river pollution characteristics is a prerequisite for the development of an efficient monitoring system to enforce the water pollution control program, which will have long-term beneficial effects on aquatic ecology and fish culture. (Bell-Graf--Cornell)
W80-01621

RIVER, ESTUARY, LAKE AND RESERVOIR QUALITY MANAGEMENT,
Department of Irrigation, Colombo (Sri Lanka).
S. H. C. De Silva.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 147-153, 1978. 1 Fig, 4 Ref.

Descriptors: *Rivers, *Estuaries, *Lakes, *Reservoirs, *Water quality, *Management, *Developing countries, Monitoring, Standards, Water resources, Water utilization, Municipal wastes, Waste disposal, Industrial wastes, Water policy.

Described are water quality criteria in general use; the parameters to be monitored in water quality management of rivers, estuaries, lakes and reservoirs are defined. The difficulties faced by developing countries in implementing standards better adapted to developed countries are listed. The goal of developing countries is the achievement of a higher standard of living for their populations. The pursuance of this objective demands growth in agriculture and industry. Such growth requires the maximum utilization of a country's water resources. Re-cycling or re-using sources of water supply become imperative. Pollution control or water quality management is thus indispensable vis-a-vis the pollution explosion. (Bell-Graf--Cornell)
W80-01624

ASSESSING RIVER WATER QUALITY BY ORDER STATISTICS,
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
S. I. Ohgaki, H. Iwai, and J. I. Matsumoto.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand. February 1978. Edited by E.A.R. Ouano, B.N. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 157-162, 1978. 7 Fig, 8 Equ, 6 Ref.

Descriptors: *Assessment, *Rivers, *Water quality, *Statistical methods, Equations, Probability, Biochemical oxygen demand, Discharge(Water), Frequency distribution, Abukuma River(Japan), Caho Phya River(Thailand).

For water pollution control, the evaluation of water quality for a certain period and at a certain station in rivers is important. Data on river water quality is, however, usually small. Herein, an attempt is made to use order statistics to estimate the probability distribution of BOD in rivers, where little data exists. The lognormal probability density functions of BOD of the Abukuma River in Japan for 1967-1973 and of the Chao Phya River in Thailand for 1970 are estimated by order statistics as actual examples. (Bell-Graf--Cornell)
W80-01625

AN ESTIMATE OF POLLUTION LOADS FROM NON-POINT SOURCE OF AN URBAN CATCHMENT,
Singapore Univ. Dept. of Civil Engineering.
K. K. Chin, and K. Y. Chen.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, February 1978. Edited by E.A.R. Ouano, V.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 163-168, 1978. 5 Fig, 6 Ref.

Descriptors: *Estimating, *Pollutants, *Urban runoff, *Canals, *Non-point sources, Rainfall, Drainage, Sampling, Flow rate, Flood water, Urban catchments.

Estimates of pollutant loads due to urban runoff at Upper Bukit Timah Catchment were made. The parameters investigated include total suspended solids, BOD, COD, organic nitrogen, and total phosphate. Data show that at a discharge less than 200 x 10 cube 10 cube m/d, pollutant loads increased with increased runoff. At higher flow rates, there was a net decrease in BOD and COD. The total phosphate and organic nitrogen loads were comparatively high. This was probably due to fertilizer and detergent being carried down to the canal during rainstorms. (Bell-Graf--Cornell)
W80-01626

EUTROPHICATION: CURRENT STATE-OF-THE-ART AND PROBABLE AREAS OF INVESTIGATION,
United Nations Educational, Scientific and Cultural Organization, Bankok (Thailand).
K. F. Jalal.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lonani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc. in USA), p 169-183, 1978. 5 Fig, 8 Equ, 22 Ref.

Descriptors: *Eutrophication, *Nutrient removal, *Technology, *Design criteria, *Phosphates, *Critical concentration, *Biochemistry, Equations, Waste water(Pollution), Water quality, Flow, Dilution, Precipitation, Surface runoff, Photosynthesis, Respiration, Developing countries.

Eutrophication is the process of enriching natural waters with nutrients. A number of questions in the field are still partially or completely unanswered. These are dealt with herein: (1) Critical concentration: What is the most critical nutrient and what is its critical concentration in natural waters. What are the possible sources and their relative importance, (2) Design criteria for nutrient removal: What is the maximum permissible concentration of critical nutrient and what should be the design criteria for its removal from waste water, and (3) Technology of nutrient removal: What is the most effective way of removal of nutrient. It is physical, chemical, biological or a combination. In any given situation, what is the specific means for achieving best results. This article considers sources of phosphate and their relative importance, design criteria for phosphate removal, and the technology of phosphate removal. It is believed that in developing countries, phosphate is the most critical nutrient responsible for eutrophication. The degree of removal of phosphate from any given wastewater may vary anywhere between zero and one hundred percent depending upon: (a) available dilution; (b) background concentration of phosphate in the receiving water; and (c) critical concentration of phosphate above which algal nuisance will occur. (Bell-Graf--Cornell)
W80-01627

POLLUTION MODELLING FOR ENCLOSED WATER BODIES,
World Health Organization, Istanbul (Turkey). Environmental Research and Training.
S. J. Arceivala.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 199-209, 1978. 2 Fig, 18 Equ, 6 Ref.

Descriptors: *Water pollution control, *Mathematical models, *Data, *Nutrients, *Oxygen balance,

*Pollution balance, *Enclosed seas, *Bays, Pollutants, Simulation analysis, Hydrodynamics, Algae, Equations, Systems analysis, Waste water discharge, Prediction.

Some form of mathematical modeling is often required for predicting nutrient and oxygen concentrations in enclosed seas and bays to which waste water is proposed to be discharge. This requires an understanding of some of the major factors and processes affecting the fate of pollutants in the water body so that they can be simulated mathematically. This paper describes how a typical pollution balance model is formulated, the nature of data required, and the calibration and use of such models. (Bell-Graf--Cornell)
W80-01628

NEW APPROACH FOR PREDICTING DISSOLVED OXYGEN LEVELS OF PULLUTED STREAMS,
Singapore Univ. Dept. of Civil Engineering.
M. A. Aziz.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 211-217, 1978. 4 Fig, 7 Equ, 10 Ref.

Descriptors: *Dissolved oxygen, *Natural streams, *Water pollution, *Prediction, Simulation analysis, Mathematical models, Equations, Systems analysis, Effluents, Downstream, Sewage, Organic pollutants, Flow, Depth, Velocity, Temperature.

This paper represents an attmept to predict dissolved oxygen levels of organically polluted streams based on rates of change of major controlling parameters which have been studied in a simulated stream under varying conditions of polluton load, micro-organisms, velocity, depth of flow, and temperature. Based on these rates, a mathematical model has been developed and tested on a natural stream polluted by a single sewage effluent discharge. The model has been found successful in predicting dissolved oxygen levels at various stations downstream. (Bell-Graf--Cornell)
W80-01629

OUTLINE OF A GLOBAL WATER QUALITY MONITORING PROGRAM,
Canada Centre for Inland Waters, Burlington (Ontario).
S. Barabas.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 221-228, 1978.

Descriptors: *Water quality, *Monitoring, *Networks, *Data storage and retrieval, *Programs, *United Nations, Effluents, Analytical quality assurance, Global, Environmental control.

A United Nations-sponsored project to monitor long-term trends in water pollution of a selected number of rivers, lakes and aquifers around the world is scheduled for gradual implementation over the next three years. The purpose of monitoring is to detect any serious deterioration of the environment as a result of the introduction of manmade pollutants and to provide advance warning to mankind. The four main components in the Global Water Quality Monitoring program (GWQM) are: (1) establishment of a global network of monitoring stations at appropriate sites; (2) adoption of uniform methodologies of water sampling and analysis; (3) application of a continuing water quality assurance program; and (4) development and use of a comprehensive data storage and retrieval system. This paper describes the origin, objectives, and operational features of the United Nations-sponsored program of international significance. Discussed are: monitoring network, including operating procedures and analytical parameters; analytical quality assurance; data storage and retrieval; and validity of global monitoring. (Bell-Graf--Cornell)
W80-01630

HETEROTROPHIC UPTAKE OF 14CO SUB 2 AND WATER POLLUTION,
Prince of Songkla Univ., Haadyai (Thailand). Faculty of Natural Resources.
D. Limpadanai.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 229-232, 1978. 3 Tab, 9 Ref.

Descriptors: *Water pollution, *Heterotrophic uptake, Water bodies, Biochemical oxygen demand, Algae, Bioassay, Rivers, Wastes concentrations, Assimilation, Waste water(Pollution).

The microbial assimilation of CO2 in water bodies is a result of metabolic activity, both autotrophic and heterotrophic biosynthesis, of various groups of microorganisms. Contrary to the standard BOD determination measuring the oxygen consumption for the decomposition of organic material, the heterotrophic uptake of CO2 labelled with 14 C in wastewater was tested and the microbial decomposition of organic matter was calculated from this value. The possibilities of using this method are discussed in comparison with algal bioassay and BOD value. (Bell-Graf--Cornell)
W80-01631

LEAF BREAKDOWN AND INVERTEBRATE COLONIZATION ON A RESERVOIR BOTTOM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-01717

IDENTIFYING THE RUSTY MONSTERS,
Saskatchewan Univ., Regina. Water Research Inst.
D. R. Cullmore, and A. McCann.
Canadian Water Well, Vol 5, No 3, p 10-19, August, 1979. 2 Fig.

Descriptors: *Iron bacteria, *Ground water, *Water analysis, Laboratory tests, Water quality, Quality control.

Symptoms of iron bacteria in water are listed. Their occurrence is often associated with the presence of iron and manganese in the water. Iron bacteria consist of three groups: Gallinoella, Crenothrix and Sphaerotilus. These bacteria can grow in aerated ground water greater than 57 degree C with greater than 0.2 ppm iron and 0.05 ppm manganese. Initial contamination of a well with iron bacteria can occur during drilling. Various tests are presented to determine the presence or iron bacteria. The 'Iron Bacteria Presence Test' (IBPT) can detect Gallionella down to about 30 cells/ml. and is also sensitive to other bacteria. A more sensitive test is needed to evaluate the effectiveness of bacteria control measures. This test involves filtering out the bacteria, incubating them, and calculating the number of bacteria present in the original sample. This test is costly and is not routinely used. (Purdin-NWWA)
W80-01719

MONITORING LANDFILLS,
National Water Well Association, Worthington, OH.
J. Weatherington.
Water Well Journal, Vol 33, No 6, p 49-51, July, 1979. 4 Fig, 1 Tab.

Descriptors: *Landfills, *Sites, *Monitoring, Geology, Precipitation(Atmsopheric), Pollutants, Municipal wastes, Leachate, Water table, Attenuation, Zone of aeration, Ground water movement, Water pollution, Locating, Observation wells.

New regulations proposed by the EPA will control the location and monitoring of new landfills to prevent local surface and ground water contamination. Monitoring methods should be site specific based a thorough evaluation of the area's geology, hydrology, and climate. The type of refuse also has to be taken into consideration. Leachate from industrial waste will contain different contaminants than that produced by household wastes. After the initial investigation, the next step in site monitoring is to drill a series of observation wells. Depth, spacing, and number of wells will depend on the geology of the site. Sampling frequencies and duration of the monitoring program will vary from site to site. Four typical landfill situations are used to illustrate specific monitoring problems and limitations. They are (1) sand and gravel over shale; (2) clay and silt over limestone; (3) sand and silt over fractured rock; and (4) sand and gravel over a series of dipping formations. (Purdin-NWWA)
W80-01731

PETROLEUM CONTAMINATION OF WELLS,
New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 5B.
W80-01737

BIOSORPTION BY MARINE FISHES OF METHIANINE AND UREA DISSOLVED IN WATER,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
I. Z. Zubchenko.
Journal of Ichthyology, Vol 7, No 3, p 336-340, 1977. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Marine fish, *Path of pollutat, *Fish physiology, Biochemistry, Radioactivity techniques, Ureas, Radioactive carbon, Laboratory tests, Nitrogen compounds, Absorption, Biological membranes, Biological properties, Dissolved organic substances, Radioactive urea, Radioactive methianine.

A study was made to determine the permeability of the integument marine fishes to dissolved organic substances. Substances used were methianine-C14 and urea C-14 isotope analysis indicates that absorption of methianine and urea by different parts of the body differs. The caudal fin is most active in absorption. The capacity of the kinetoblast and the phagocyloblast to biosorb organic substances dissolved in water was demonstrated in the porgy and the scad. (Kate-EIS)
W80-01742

THE EFFECT OF DIMETHYL SULFATE ON THE REPRODUCTIVE SYSTEM OF THE LOACH, MISGURNUS FOSSILIS,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
A. G. Khvoles, and Yu. A. Korobko.
Journal of Ichthology, Vol 7, No 2, p 333-336, 1977. 1 Fig, 1 Tab.

Descriptors: Freshwater fish, Water pollution effects, *Path of pollutants, Bioassay, Laboratory tests, *Pulp and paper industry, *Dimethyl sulfate, Fish physiology, Animal pathology, *Reproduction, Gametogenesis, Aquiculture, Industrial wastes, Industrial water.

An investigation is made of the effect of dimethyl sulfate, a component of industrial wastes, on the reproduction of the loach, Misgurnus fossilis. The investigations indicate that in the nuclear-nucleolar cell systems substantial changes occur in the actual dimensions of the nuclei and nucleoli subjected to dimethyl sulfate and in the processes of the synthesis occurring in the cells. The authors concluded that above threshold concentrations, the process of gametogenesis in fish may be disturbed. (Kate-EIS)
W80-01743

EFFECT OF HEXACHLORANE (HCCH) ON SOME HEMATOLOGICAL AND BIOCHEMICAL CHARACTERISTICS OF THE BLOOD OF THE ROUND GOBY (GOBIUS MELANOSTOMUS),
Odessa State Univ. (USSR).
F. S. Zambriborshch, and B. Lay.
Journal of Ichthyology, Vol 7, No 3, p 507-510,

1977. 2 Tab, 15 Ref.

Descriptors: *Pesticides, *Chlorinated hydrocarbon insecticides, *Hexachlorane, Bioassay, Laboratory tests, Animal pathology, Fish physiology, Biochemistry, Marine fish, *Fish hematology, Blood sugar content, Peroxidase activity, Blood chemistry, Round guppy.

The objective was to elucidate the toxicity of low hexachlorane (HCCH) concentrations for marine fishes. The effects of HCCH on the hematological characteristics, the blood sugar content and the peroxidase activity of the round guppy was determined. In addition, at concentrations around the maximum permissible (0.012-0.024 mg/liter) hexachlorane initially increases, but subsequently decreases the number of erythrocytes and leukocytes and the amount of hemoglobin. These indicators are not restored after the fish have spent 3 days in pure water. The amount of blood sugar declines in fish poisoned with hexachlorane and does not return to normal in pure water over a period of 3 days. Peroxidase activity is the characteristic that is most sensitive to the effect of hexachlorane, and is reduced. (Katz-EIS)
W80-01745

INFLUENCES OF DIELDRIN ON THE GROWTH AND BODY COMPOSITION OF FINGERLING RAINBOW TROUT (SALMO GAIRDNERI) FED OREGON MOIST PELLETS OR TUBIFICID WORMS (TUBIFEX SP.),
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
G. R. Phillips, and D. R. Buhler.
Journal of the Fisheries Research Board of Canada, Vol 36, p 77-80, 1979. 3 Fig, 1 Tab, 25 Ref.

Descriptors: *Rainbow trout, Oligochaetes, *Chlorinated hydrocarbon pesticides, Pesticides, Insecticides, *Fish diets, Fish food organisms, Toxicity, Mortality, Bioassay, Laboratory tests, Tubificids, Aquiculture, Fish physiology, Biochemistry, *Dieldrin, Growth, Fat metabolism.

Fingerling rainbow trout (Salmo gairdneri) fed tubificid worms (Tubifex sp.) grew faster than those fed Oregon Moist Pellets (OMP) over a similar range of rations. Faster growth resulted because trout incorporated protein and fat from tubificids more efficiently than from OMP. Exposure to a sublethal concentration of dieldrin in water (0.18 microg/L) did not affect the protein elaboration of trout fed either diet or fat metabolism in trout fed OMP. However, dieldrin reduced fat elaboration in trout fed tubificids. The dieldrin concentrations in trout exposed to dieldrin in water increased as feeding level (and therefore body fat) increased. The different responses to dieldrin by fish fed these two diets provides evidence that the diet offered to fish can significantly influence the outcome of chronic toxicity tests. (Katz-EIS)
W80-01746

METHYLATED ARSENIC FROM MARINE FAUNA,
Western Australia Dept. of Fisheries and Fauna, Perth. Marine Research Labs.
J. S. Edmonds, and K. A. Francesconi.
Nature, Vol 265, p 436, 1977. 9 Ref.

Descriptors: *Arsenic compounds, Inorganic arsenic, *Methylated arsenic, Mussels, Lobsters, Marine fish, Public health, *Commercial fish, *Commercial shellfish, Chemical analysis, Australia, Western Australia, Toxicity.

Mussels, western rock lobsters, (Panulirus longipes planulatus) and stingray collected form Garden Island and Cockburn Sound, in western Australia contain dimethylated and trimethylated arsenic together with a small proportion of inorganic arsenic. It is evident that most arsenic in marine fauna is organically bound and is nontoxic. (Katz-EIS)
W80-01747

MACROBENTHIC DIVERSITY AND ORGANIC POLLUTION IN THE ARCHIPELAGO OF ALAND (N BALTIC),
Abo Akademi Turku (Finalnd). Inst. of Biology.
J. Westerberg.
Aqua Fennica, Vol 8, p 70-77, 1978. 3 Fig, 3 Tab, 9 Ref.

Descriptors: *Benthos, *Marine animals, Organic loading, *Organic wastes, Domestic wastes, Industrial wastes, On-site investigation, Water pollution effects, Aland archipelago, Baltic Sea, Organic pollution, Diversity index.

Twelve localities with a total number of 26 stations within the Aland archipelago (N Baltic) were investigated. The localities represent different degrees of exposition to water movements. Some of them are subject organic pollution being loaded by industrial and municipal wastes. A pollution index (BCI) was used to evaluate the dominance diversity index derived rrom the Shannon-Weiner function as a measure of organic pollution. The BCI was based on both qualitative characteristics and quantitative data of soft-bottom macrofauna. Diversity and organic pollution were shown to be positively correlated within restricted areas. Estimations of diversity for comparative purposes when measuring organic pollution of widely different areas showed to be meaningless. Yet diversity seemed to be correlated to organic pollution from polluted to semi-healthy bottoms, whereas very low values of diversity were obtained for the most healthy bottoms. (Katz-EIS)
W80-01748

HEAVY METAL RESIDUES IN DULSE, AN EDIBLE SEAWEED,
Fisheries and Marine Service, Halifax (Nova Scotia). Halifax Lab.
G. R. Sirota, and J. F. Uthe.
Aquaculture, Vol 18, p 41-44, 1979. 1 Fig, 3 Tab, 4 Ref.

Descriptors: *Heavy metals, *Spectroscopy, *Foods, Chemical analysis, Marine plants, Copper, *Cadium, *Lead, *Zinc, *Mercury, Water chemistry, Atlantic Ocean, Aquiculture, *Seaweed, *Dulse, *Palmaria, *Arsenic, *Selenium.

The Seaweed commonly known as dulse (Palmaria Palmata Guiry) has been consumed as a snack food and vegetable since the early nineteen-hundreds Although it is a relatively common snack food on the eastern coast of North America, little is known about its elemental composition. Dulse from three geographically different areas and a common holding tank was analyzed for As, Cu, cd, Pb, Se, Zn and Hg by flameless atomic absorption spectroscopy. Concentration ranges (microg/g dry weight) were: As 5.50-7.50, Cu 3.90-6. 34, Cd 0.97-2.65, Pb 0.688-3.5, Se 2.00-2.91, Zn 57.5-84.1, Hg < 0.02. Percent moisture was 13.50-23.45 in terms of safety as a food item, the heavy metal values for dulse reported in this paper lie well within those established for a foodstuff. (Deal-EIS)
W80-01757

THE EFFECTS OF CHLORINE, ELEVATED TEMPERATURE AND EXPOSURE DURATION OF POWER PLANT EFFLUENTS ON LARVAL WHITE PERCH MORONE AMERICANA (GMELIN),
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
L. W. Hall, Jr., D. T. Burton, and S. L. Margrey.
Water Resources Bulletin, Vol 15, No 5, p 1365-1373, 1979. 2 Fig, 1 Tab, 24 Ref.

Descriptors: *Larval growth stage, *Chlorine, *Water temperature, *Toxicity, White perch, Mortality, Lethal limit, Fish physiology, Powerplants, Thermal pollution, Cooling waters, Heated water, Heat resistance, Bioassay.

Chlorine-termperature interaction studies with various exposure times were conducted on 25-day old larval white perch. The interactions of chlorine, temperature change and exposure periods were established by regression model techniques. An initial interaction model showed that temperature change was not a factor which contributed to death. A predictive model for chlorine and exposure duration was constructed which showed that potential impact to larval white perch from chlorine at power facilities with once through cooling systems can be minimized by (1) using short duration expoures (<1 hour) to chlorine in plants that chlorinate intermittently or (2) by rapid mixing in the receiving stream in plants that chlorinate on low level (<0.05 mg/1) continuous basis. Similar considerations should be given to cooling tower blowdown which contain chlorinated water. (Deal-EIS)
W80-01759

COPPER AND NUTRITION IN HELIX POMATIA (L.),
Innsbruck Univ. (Austria). Inst. fuer Zoophysiologie
H. Moser, and W. Wieser.
Oecoligia, Vol 42, p 241-251, 1979. 2 Fig, 6 Tab, 24 Ref.

Descriptors: *Copper, *Snails, *Adsorption, Chemical analysis, Path of pollutants, Heavy metals, Animal populations, Seasonal, Gastropods, Isopods, Animal physiology, Animal metabolism, Feeding rates, *Tissue analysis, *Bioaccumulation, *Helix.

In Helix pomatia the efficiency of assimilation of both food (lettuce) and copper is always high, even when the food has been artificially enriched with copper. In short-term feeding experiments with lettuce conaining 1390 ppm copper about 97% of the metal ingested remains in the snail. The availability of copper in the faeces is independent of the type of food and does not differ much from the availability of the metal in untreated lettuce. About half of the metal can be extracted by 0.1 MCl, whereas the half is liberated only by ashing. The concentration of copper in the organs of a natural population of H. pomatia varied between 20 and 120 ppm (dry weight). Being by far the largest organ the foot contains most of this copper. After the snails have fed on copper-enriched food for three weeks the concentration of copper increases mainly in the alimentary tract and in the midgut gland, but no one organ is capable of concentrating copper to a much higher degree than another. In winter animals which had been feeding on copper-enriched food prior to hibernation, the concentration of copper in several organs may reach values that are from 10 to 40 times higher than those in summer animals. (Deal-EIS)
W80-01760

METABOLIC RESPONSES TO TEMPERATURE CHANGE IN A TROPICAL FRESHWATER COPEPOD (MESOCYCLOPS BRASILIANUS) AND THEIR ADAPTIVE SIGNIFICANCE,
Colorado Univ., Boulder. Dept. of Environmental, Population and Organismic Biology.
R. W. Epp, and W. M. Lewis, Jr.
Oecologia, Vol 42, p 123-138, 1979. 2 Fig, 7 Tab, 68 Ref.

Descriptors: *Copepods, *Animal metabolism, *Water temperature, Seasonal, Adaptation, Growth stages, Animal behavior, Vertical migration, Tropical regions, Biorhythms, Aquatic animals, habitats, Venezuela, Lake Valencia, *Mesocyclops.

Metabolic rates of Mesocyclops brasilianus from Lake Valencia, Venezuela, were determined at several temperatures spanning the environmental range (22-28C). The oxygen consumption per unit weight of all Mesocyclops stages from Lake Valenica are higher than most but not all CO2's from temperate copepod species that have been studied. Acclimated copepodite and adult Mesocyclops show a decreasing metabolic rate with increasing temperature over the temperature range 26-28C.
W80-01761

TEMPERATURE REQUIREMENTS OF FISHES FROM EASTERN LAKE ERIE AND THE UPPER NIAGARA RIVER: A REVIEW OF THE LITERATURE,

State Univ. of New York Coll. at Buffalo. Dept. of Biology.
J. R. Spotila, K. M. Terpin, R. R. Koons, and R. L. Bonati.
Environmental Biology of Fishes, Vol 4, No 3, p 281-301, 1979. 5 Tab, 193 Ref.

Descriptors: *Water temperature, *Lake Erie, *Habitats, Thermal stress, Heat resistance, Thermal pollution, Great Lakes, Fish populations, Aquatic environment, Spawning, Fish physiology, Biological communities, Sunfishes, Trout, Heated water, Eutrophication, Carp, Catfishes, Sockeye salmon, Freshwater fish, Channel catfish, Brown trout, Sunfish, Whitefish.

Literature on the temperature requirements of fishes expected to occur in eastern Lake Erie and the upper Niagara River is reviewed. Seventy-four species of fishes are reported from Lake Erie and sixty-one from the upper Niagara River. Incipient upper lethal temperatures range from 23C for Salmo trutta to 41C for Carassius auratus and Ictalurus nebulosus. Preferred temperatures ranged from 10C for Coregonus clupeaformis to 31.1C for Lepomis macrochirus. Spawning temperatures ranged from 3.8C for C. artedii to 15.6-27.7C for Alosa pseudoharengus. Data is discussed in terms of the effects of thermal effluents on individuals of a species, structure of aquatic communities and impact on ecosystems. Synergistic effects of temperature and toxicants and disruption of spawning are potentially the most damaging direct effects of thermal effluents. Heated water may be contributing to the present rate of eutrophication in the lake and river. Increased input of thermal effluents into the eastern basin of Lake Erie will maintain a stress on the fishery and may irreversibly damage it. (Deal-EIS)
W80-01763

COMBINED EFFECTS OF TEMPERATURE AND SALINITY ON THE SURVIVAL AND GROWTH OF THE LARVAE OF PANDALUS JORDANI (DECAPODA: PANDALIDAE),
Oregon State Univ., Newport. Marine Science Center.
P. C. Rothlisberg.
Marine Biology, Vol 54, p 125-134, 1979. 7 Fig, 2 Tab, 39 Ref.

Descriptors: *Water temperature, *Salinity, *Toxicity, *Growth rates, *Shrimp, Larval growth stage, Salt tolerance, Size, Mortality length, Animal physiology, Juvenile growth stage, Commercial shellfish, *Decapods, *Pandalus,.

Suvival and growth over an environmeental range of temperature and salinities were examined in order to help assess the importance of these environmental factors in affecting the distribution, abundance and survival of larvae and provide greater understanding of factors affecting fluctuations in adult Pandalus jordani Rathbun population sizes. Larvae were shown to have a wide tolerance to salinity, especially in the early stages, but a relatively narrow tolerance to temperature. The optimal temperatures for survival, 8C to 11C, were also optimal for growth as reflected by maximal growth increments and body size. It is therefore felt that fluctuations in temperature as seen within and between successive larval seasons would have profound effects on larval survival, growth rates and size at metamorphosis to the benthic juvenile phase. (Deal-EIS)
W80-01764

FACTORS AFFECTING THE FLUX OF ARSENIC THROUGH THE MUSSEL MYTILUS GALLOPROVINCIALIS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
M. Y. Unlu, and S. W. Fowler.
Marine Biology, Vol. 51, p 209-219. 1979. 6 Fig, 4 Tab, 38 Ref.

Descriptors: *Arsenic compounds, *Path of pollutants, *Mussels, Tracers, Radiochemical analysis, Arsenic radioisotopes, Size, Animal physiology, Animal metabolism, Water temperature, Salinity, Absorption, Chemical analysis, *Mytilus, *Tissue analysis, *Bioaccumulation, *Depuration, *Arsenic.

Radiotracer experiments were designed to study the effects of certain environmental and biological factors on arsenic accumulation and elimination processes in the Mediterranean Mussel Mytilus galloprovincialis. Arsenic (as arsenate) uptake increased with increasing arsenic concentration in the water; however, the response was not prorportional, indicating that accumulation was partially suppressed at higher external arsenic concentrations. In general, approximately 80% of the 74 As taken up was associated with the soft parts, with small mussels concentrating 74 as to a greater degree than large individuals. The highest 74 As concentrations were recorded in the byssus and the digestive gland. Increased temperature enhanced both arsenic uptake and loss. Mussels in sea water at 19% S accumulated approximately three times more 74 As than those held at 38% S. Arsenic loss was much less affected by salinity, with only a tendency for greater arsenic retention noted at lower salinities. Studies carried out in the laboratory and in situ revealed that arsenic turnover was significantly more rapid in actively growing individuals living under natural conditions, Arsenic-74 loss from the in situ group was essentially buphasic, with biological half-times of approximately 3 and 32 days for the fast and slow compartments, respectively. The active secretion of arsenic in the byssal threads contributed to the total elimination of the element from the mussels. (Deal-EIS)
W80-01765

PELAGIC TAR CONCENTRATIONS IN THE GULF OF MEXICO OVER THE SOUTH TEXAS CONTINENTAL SHELF,
Texas A and M Univ., College Station. Dept. of Oceanography.
L. H. Pequegnat.
Contributions in Marine Science, Vol 22, p 31-39, 1979. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Oil pollution, *Gulf of Mexico, Baseline studies, Oil, Sampling, Monitoring, Seasonal, Path of pollutants, Organic compounds, Texas, Analytical techniques, Water pollution sources, *Tar, *Crude oil.

Dry weight of tar from 189 neuscon samples over the South Texas continental shelf ranged from 0 to 31.86 mg/sq m during a two-year (1976-77) monthly monitoring study with an overall average of 1.6 mg/sq m. This average is not inconsistent with previously reported averages for the Gulf of Mexico, which are considerably lower than tar values reported for the Mediterranean and Sargasso Seas. Inshore stations and offshore stations averaged slightly lower tar concentrations (1.24 and 1.43 mg/sq m) than the intermediate positioned stations (2.30 mg/sq m) on all transects. Monthly average tar concentrations varied, but highest values occurred in the Spring (March-April, 6.7 and 5.8 mg/sq m) and December (3.3 mg/sq m) periods. Two northern transects, one off the Port Aransas-Corpus Christi area and the other off the Port Lavaca-Port O'Connor area, averaged considerably higher tar values (1.47 and 2.32 mg/sq m) than the two more southerly transects 0.54 and 0.27 mg/sq m). (Deal-EIS)
W80-01766

ACCLIMATION RESPONSES TO SALINITY OF THREE ESTUARINE RED ALGAE FROM NEW JERSEY,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.
C. Yarish, P. Edwards, and S. Casey.
Marine Biology, Vol 51, p 289-294, 1979. 4 Fig, 1 Tab, 25 Ref.

Descriptors: *Rhodophyta, *Salinity, *Photosynthesis, Salt tolerance, Sea water, Adaptation, Metabolism, Estuarine environment, Marine algae, Cytological studies, New Jersey, Estuaries, Estuarine algae.

The effects of salinity and acclimation time on the net photosynthetic responses of 3 estuarine red algae, Bostrychia radicans, Caloglossa leprieurii, and Polysiphonia subtilissima, from Great Bay Estuary, New Jersey, were investigated. The algae were cultured in a series of synthetic seawater media of 5, 15, 25 and 35 ppt S for acclimation periods of 0, 2, 4, 8, and 16 days prior to determining their photosynthetic responses. All species were euryhaline, and demonstrated photosynthesis at all the above salinities. B. radicans, which was more common towards the mouth of the estuary, had maximum photosynthetic rate at 25 ppt S, whilst C. leprieurii and P. subtilissima, which were more common towards the head of the estuary, had photosynthetic maxima between 15 and 25 ppt, and at 15 ppt, respectively. The curves relating net photosynthesis to salinity were usually similar within a species at different acclimation periods, although statistically significant differences were sometimes noted. The acclimation periods producing maximal net photosynthesis were 0, 2 and 4 days for B. radicans, and 4 days for C. leprieurii, whilst for P. subtilissima there was no significant difference in response for any acclimation period over the range of salinities studied. (Deal-EIS)
W80-01769

EVALUATION OF THE CRITICAL THERMAL MAXIMUM FOR DETERMINING THERMAL TOLERANCE OF FRESHWATER FISH,
Battelle Pacific Northwest Labs., Richland, WA.
C. D. Becker, and R. G. Genoway.
Environmental Biology of Fishes, Vol 5, No 3, p 245-256, 1979. 4 Fig, 2 Tab, 36 Ref.

Descriptors: *Water temperature, *Heat resistance, *Sockeye salmon, *Sunfishes, Toxicity, Fish physiology, Laboratory tests, Analytical techniques, Methodology, Mortality, Fish behavior, Size, Thermal stress.

Upper loss of equilibrium and death temperatures were determined by the critical thermal maximum (CTM) method for juvenile coho salmon acclimated to 5 and 15C, and for pumpkinseed sunfish acclimated to 10 and 20C. Temperatures increase rates were 1, 6, 18, 30 and 60 C/h. Analysis of variance showed significant differences due to acclimation level, temperature increase rate, and an interaction between these variables. CTM values for coho, a stenothermal fish, were lower than those for pumpkinseed, an eurythermal fish. Generally, higher acclimations and more rapid rates of temperature increase produced higher CTM values. Upward acclimation during testing was detected only for 10C acclimated pumpkinseed at a 1 c/h increase rate. Assessments were made for CTM procedural relationships from test data and the literature. A standard increase rate of 18 decrees c/h (0.3C/min) is recommended for routine CTM determinations with fish. Other recommendations are: (1) Test fish should be small, and relatively uniform in size and condition; (2) final loss of ability to return upright should be the loss of equilibrium criterion; (3) death also should be included as a criterion in CTM determinations, with the term 'lethal thermal maximum' applied for death temperature; and (4) linearity should be maintained in time-temperature distributions of the heating rate. (Deal-EIS)
W80-01775

EFFECTS OF TEMPERATURE AND SALINITY ON THE GROWTH OF THE BENTHIC DIATOM NITZSCHIAOVALIS ARNOTT (BACILLARIOPHYCEAE),
Texas A and M Univ., Galveston. Dept. of Biology.
L. K. Medlin, and W. B. Wilson.
Contributons in Marine Science, Vol 22, p 127-136, 1979. 3 Fig, 3 Tab, 36 Ref.

Descriptors: *Diatoms, *Growth rates, *Water temperature, *Salinity, Salt tolerance, Toxicity, Gulf of Mexico, Benthic flora, Systematics, Classification, Varieties, Marine algae.

Temperature and salinity tolerance of Nitzschia ovalis and the effects of combinations of these factors on its growth show that it is a eurythermal and euryhaline benthic diatom. The effect of these environmental factors on benthic microflora is seldom stuied in vitro. N. ovalis reported here for

the time from the Guld of Mexico, grew well at salinity levels from 8 to 53 o/oo and temperature levels from 12 to 36C. Maximum growth rates occurred at combinations of 28, 30, 32C, and 28, 32 o/oo salinity. The implication of these findings to natural populations of N. ovalis are discussed. (Deal-EIS)
W80-01776

TOXICITY AND BIOCONCENTRATION OF EPN AND LEPTOPHOS TO SELECTED ESTUARINE ANIMALS,
Environmental Research Lab., Guld Breeze, FL.
S. C. Schimmel, T. L. Hamaker, and J. Forester.
Contributons in Marine Science, Vol 22, p 193-203, 1979. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Toxicity, *Insecticides, Bioassay, Mortality, Life cycles, Lethal limit, Growth stages, Path of pollutants, Pesticide toxicity, Fish physiology, Absorption, Pink shrimp, Shrimp, *Leptophos, *EPN, *Bioconcentration, *Depuration, *Leiostomus, *Spot, *Pinfish, *Lagodon.

Acute (96-hr) flow-through toxicity tests, chronic (entire life-cycle) tests, and bioconcentration studies were conducted on selected estuarine animals with the insecticides, EPN, and leptophos. In the EPN acute toxicity tests, the test animals and their 96-h LC50 values were: Mysidopsis bahia, 3.44 microg/l; Penaeus duorarum, 0.29 microg/l; Cyprinodon variegatus, 188.9 microg/l; Lagodon rhomboides, 18.3 microg/l; and Leiostomus xanthrurus, 25.6 microg/l. Test animals and 96-h LC50 values for leptophos were: M. bahia, 3.16 microg/l; P. duorarum, 1.88 microg/l; and L. xanthurus, 4.06 microg/l. In separate chronic tests, M. bahia were exposed to EPN and leptophos. Significant mortality and fewer young were produced in 4.13 microg/l EPN. in the leptophos chronic test, significant mortality occurred in concentrations 3.63 microg/l and fewer young were produced in concentrations 1.77 microg/l. L. rhomboides, exposed to EPN in a 26-day uptake study, bioconcentrated the insecticide 707 X that measured in the exposure water. When L. rhomboides were held in EPN-free seawater, no EPN was detected in their tissues after eight days. L. xanthurus, exposed to leptophos for 26 days, bioconcentrated the insecticide to only 68 X the concentration in the exposure water. No leptophos residues were detectable in tissues after 4 days depuration. Our results indicate that if either insecticide contaminated an estuarine environment in concentrations 1.0 microg/l, the most profound adverse effects on crustaceans and possbily fishes would result from acute toxicity, rather than from chronic toxicity or bioconcentration of the chemicals. (Deal-EIS)
W80-01778

PETROLEUM IN DEEP BENTHIC ECOSYSTEMS OF THE GULF OF MEXICO AND CARIBBEAN SEA,
Texas A and M Univ., College Station. Dept. of Oceanography.
W. E. Pequegnat, and L. M. Jeffrey.
Contributions in Marine Science, Vol 22, p 63-75, 1979. 2 Fig, 4 Tab, 15 Ref.

Descriptors: *Oil, *Gulf of Mexico, Oil pollution, Baseline studies, Monitoring, Pollutant identification, Chemical analysis, Organic compounds, Sampling, Benthic fauna, Gas chromatography, Water pollution sources, Sulfur, Nickel, *Caribbean Sea, *Tar, *Starfish, *Vanadium.

Petroleum hydrocarbons were analyzed from 74 benthic tar samples collected between 1967 and 1973 in the Gulf of Mexico in depths ranging from 180-3843 m and from 12 stations in the Caribbean Sea in depths of 522-4557 m. Chemical analyses showed the tars to contain no volatile hydrocarbons in the range of C10 to C40, to be highly asphaltic, low in paraffins, and unusually high in sulfur, vanadium and nickel. Evidence is presented for natural petroleum seeps from several areas in the western Gulf of Mexico, including salt diapirs (Vema Knolls), and from an area of ironstone deposits in the northeastern Gulf. Specimens of the starfish, Persephonaster echinulatus, from a southwest Gulf of Mexico station were found engulfing and solubilizing tar lumps. Plant material, often of terrestrial origin, was found in 56% of the Gulf of Mexico tar stations and 100% of the Caribbean tar stations. A rich and varied bottom fauna was found associated with stations yielding large amounts of plant material and oil. (Deal-EIS)
W80-01780

SOURCE AND LEVEL OF MERCURY IN A NEW IMPOUNDMENT,
Southern Illinois Univ. at Carbondale.
For primary bibliographic entry see Field 5B.
W80-01813

HYDROCARBONS IN BENTHIC ALGAE FROM THE EASTERN GULF OF MEXICO,
Gulf Coast Research Lab., Ocean Springs, MS.
J. S. Lytle, T. F. Lytle, J. N. Gearing, and P. J. Gearing.
Marine Biology, Vol 51, p 279-288, 1979. 4 Fig, 4 Tab, 27 Ref.

Descriptors: *Oil, *Benthic flora, *Gulf of Mexico, Aromatic compounds, Organic compounds, Marine algae, Chemical analysis, Rhodophyta, Chlorophyta, Phaeophyta, Gas chromatography, Bioindicators, Monitoring, Analytical techniques, *Aliphatic compounds.

Thirty-six samples of benthic algae were collected from the continental shelf along the eastern Gulf of Mexico. The algae contain 82.8 plus or minus 143 ppm aliphatic hydrocarbons by dry weight and 11.8 plus or minus 22.7 ppm aromatic and polyolefinic hydrocarbons. The aliphatic constituents of red algae are composed almost entirely of n-C17 (70 to 95% of aliphatic weight); green algae have varying amounts of n-alkanes in the range of n-C15 to n-C19, with homologous series of odd carbon number n-alkenes. Phytadienes occur as high as 740 ppm dry weight in the green algae and do not appear to be related to time or place of collection or to presence of any petroleum pollutants. The single brown algal species contains predominantly n-C15. About 30% of the samples have hydrocarbons resembling degraded petroleum residues, but no petroleum pollution of recent origin was detected in any specimen. (Deal-EIS)
W80-01844

SAMPLING PROGRAMS FOR EVALUATING UPLAND MARSH TO IMPROVE WATER QUALITY,
Florida Univ., Belle Glade. Dept. of Agricultural Engineering.
S. F. Shih, A. C. Federico, J. F. Milleson, and M. Rosen.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 828-833, july-August 1979. 4 Fig, 6 Tab, 8 Ref.

Descriptors: *Water quality, *Marshes, *Nutrients, *Sampling, *Florida, Freshwater marshes, Nitrogen, Phosphorus, Calcium, Water chemistry, Soils, Vegetation, Flow, Effects.

Performance of upland marsh to improve water quality was evaluated using an indirect sampling program which included the water chenistry, marsh vegetation, nutrient uptake, soil profile nutrient content, and flow velocity measurement. The results indicated that the retention rates for phosphorus were about 2.0-9.8 mg/day/sq m, the release rate for nitrogen was about 0.7-5.9 mg/day/sq m, the nutrient uptake rates by vascular marsh vegetation were 0.031 and 0.007 g/day sq m for nitrogen and phosphorus, respectively; the highest concentrations for nitrogen, phosphorus, and calcium were in the top 15 cm layer of the soil; and the flow velocity in the marsh ranged from 1.2 to 2.8 cm/s during the middle of wet season. (Sims-ISWS)
W80-01852

KALMAN FILTER MODELING OF THE SPEED RIVER QUALITY,
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
For primary bibliographic entry see Field 5B.
W80-01860

MATHEMATICAL MODELING OF DISSOLVED OXYGEN IN MIXED ESTUARIES,
Department of Local Government, Brisbane (Australia).
For primary bibliographic entry see Field 5B.
W80-01861

A MODEL FOR NITRATE-NITROGEN TRANSPORT AND DENTRIFICATION IN THE RIVER THAMES,
Thames Water Authority, Reading (England), Thames Conservancy Div
For primary bibliographic entry see Field 5B.
W80-01863

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5B.
W80-01865

SUSPENDED SEDIMENT-PHOSPHORUS RELATIONSHIPS FOR THE INFLOW AND OUTFLOW OF A FLOOD DETENTION RESERVOIR,
Science and Education Administration, Oxford, MS. Sedimentation Lab
For primary bibliographic entry see Field 5B.
W80-01872

SEDIMENT HYDROCARBONS NEAR AN OIL RIG,
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry
For primary bibliographic entry see Field 5B.
W80-01885

WINTERTIME RAW-WATER CONTAMINATION AT CHICAGO'S SOUTH WATER FILTRATION PLANT,
Argonne National Lab., IL.
For primary bibliographic entry see Field 5B.
W80-01886

THE EFFECT OF NICKEL ON THE GROWTH OF THE FRESHWATER DIATOM NAVICULA PELLICULOSA,
Notre Dame Univ., IN. Dept. of Biology.
J. S. Fezy, D. F. Spencer, and R. W. Greene.
Environmental Pollution, Vol 13, p 131-137, 1979. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Nickel, *Toxicity, *Growth rates, *Diatoms, Cytological studies, Heaby metals, Aquatic populations, Aquatic algae, Inhibition, Mode of action, Water chemistry, Bioassay, Laboratory tests, *Navicula.

The effect of nickel on the growth of the freshwater diatom Navicula pelliculosa was determined by noting differences in the growth rate and number of cells present in laboratory cultures exposed to 0, 100, 300 and 600 microg/litre nickle for 14 days. Nickel concentrations as low as 100 microg/litre reduced the population growth rate by 50% and led to decreased 14-day cell numbers. Calculation of the equilibrium composition of the culture medium showed that 99.8% of the total nickel added existed as Ni+2. The occurrence of Ni+2 in the medium was associated with reduced algal growth. (Deal-EIS)
W80-01897

THE EFFECTS OF TOLUENE ON EMBRYOS AND FRY OF THE JAPANESE MEDAKA ORYZIAS LATIPES WITH A PROPOSAL FOR RAPID DETERMINATION OF MAXIMUM ACCEPTABLE TOXICANT CONCENTRATION,
State Univ. of New York Coll. at Brockpost. Dept. of Biological Sciences.

F. W. Stoss, and T. A. Haines.
Environmental Pollution, Vol 13, p 139-148, 1979. 4 Fig, 1 Tab, 19 Ref.

Descriptors: *Growth stages, *Toxicity, *Bioassay, Fry, Fish eggs, Embryonic growth stage, Fish physiology, Mode of action, Methodology, Organic compounds, Oil, Mortality, *Toluene, *Teratogens, *Mutagens, *Medaka, *Oryzias.

Fertilised eggs at various stages of development and newly hatched fry of medaka were exposed to a series of concentrations of the water-soluble extract of toluene. Static bioassays were conducted and TL50 calculations made. In addition, the embryos were examined for the presence of developmental anomalies. The mean 96 f TL50 for eggs was 54 mg/litre. The early (<3.5h) and late (>192h) stages were more sensitive than the average. The newly hatched fry were not as sensitive to toluene as were the embryos. In addition to acute toxicity effects, concentrations of toluene as low as 41 mg/litre produced teratogenic effects in susceptible embryos. We propose that the observation of these defects in the transparent eggs constitutes a simple and rapid tool for the estimation of Maximum Acceptable Toxicant Concentration (MATC) for fish. (Deal-EIS)
W80-01922

MONITORING AREAWIDE RURAL WATER QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
L. F. Bliven, F. J. Humenik, F. A. Koehler, and M. R. Overcash.
Journal of the Environmental Engineering Division of the American Society of Civil Engineering, Vol 105, No 1, P 101-112 February 1979, 1 Fig, 4 Tab, 10 Ref.

Descriptors: *Sampling, *Water quality, *Chowan River basin(NC, VA), On-site data collections, Estimating, Statistical methods, Baseline studies, Automated sampling, North Carolina, Grab sampling, Monitoring, Virginia.

As an alternative to expensive complete and continuous methods of monitoring areawide water pollution from nonpoint sources, statistical sampling methods are proposed which can de used to account for both spatial and temporal variations in water quality parameters. Grab sampling and automated sampling are two common methods of assessing stream water quality which can be used in a statistically designed sampling program. To illustrate sampling plans which mimimize bias and imprecision from sampling methodology, point-in-time comparisons of manually depth-integrated and fixed-point automated samples were conducted for COD, TOC, TP, TKN, N03N, and CL in various rural portions of the Chowan River basin in North Carolina and Virginia. Results of these studies show that: (1) A flush-sample cycle rather than a sample-flush cycle should be employed with automated sampling, so that material which may have settled or grown in the sample intake can be expelled before a sample is obtained. (2) Chemical preservation should be considered when refrigeration of samples is not feasible. (3) If acid fixation is employed, field storage time should be as short possible to minimize chemical oxidation of the organics which can be reducing TOC and COD concentrations. (4) Use of daily weather predictions as a means of time stratification could be tried to improve water yield estimate precision at a given-grab-sampling intensity. (Harris-Wisconsin)
W80-01976

AUTOMATIC WATER/SEWER SAMPLER,
C. Farnworth.
U.S. Patent No. 4,166,392, 8 p, 4 fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 986, No 1, p 41, September 4, 1979.

Descriptors: *Patents, *Sampling, *Water sampling, On-site data collections, Automation, Sewers, Dye releases.

An automatic water/sewer sampler, is a totally immersible, rechargeable battery powered, and is of rustproof stainless and aluminum construction. It is constructed so that it may be suspended under water at a raw water inlet or from a ladder rung to hand in a sanitary sewer flow. The bottom fill feature permits taking a sample in a flow level of six inches or less. It is not affected by atmospheric pressure. The samples are collected in vacuum flasks, surrounded by insulation material to protect the biological and temperature conditions of the sample until the device is returned to the laboratory for analysis. When installed in the field, the device will take a (500) milliliter sample each hour for eight hours, and the knife edge sample flask gate valve will open to accept up to half inch lumps of particulate matter and still shear through to seat and seal. The sampler also features a 'reverse cycle; in which the device may be filled with liquid chemicals or trace dyes in the laboratory to be time released at the field site. (Sinha-OEIS)
W80-01992

5B. Sources Of Pollution

NITROGEN MOVEMENT TO LAGUNA LAKE THROUGH DRAINAGE FROM RICE FIELDS,
International Rice Research Inst., Los Banos, Laguna (Philippines).
V. P. Singh, T. H. Wickham, and I. T. Corpuz.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 141-145, 1978. 3 Tab, 9 Ref.

Descriptors: *Nitrogen, *Water movement, *Nutrient losses, *Drainage, *Laguna Lake, Surface waters, Water treatment, Management, Runoff, Fertilizer, Irrigation, Water supply, Crops, Flow.

Nitrogen losses through surface drainage showed considerable variation by site, treatment and time. All treatments in both seasons lost less N (1.1 kg/ha per crop) with incorporated N than with top-dressed N (2.9 kg/ha per crop). The difference was greatest where water was supplied continuously. Treatments with incorporated N and infiltration water management had the least losses; in fact, there was a net gain of 1.8 kg/ha per crop for these treatments. Among the water management treatments, continuous flow resulted in maximum loss (5.5 kg/ha per crop), while the infiltration treatments resulted in a net gain of 1.5 kg/ha per crop. (Bell-Graf--Cornell)
W80-01623

A SIMPLIFIED STREAM MODEL OF ACID MINE DRAINAGE EFFECTS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
R. A. Chadderton.
Water Resources Bulletin, Vol 15, No 4, p 1159-1167, August 1979. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Acid mine water, *Mathematical models, *River systems, *Acid streams, *Acid-base equilibrium, Rivers, Water quality, Alkalinity, Travel time, Carbon dioxide, Reaeration, Mixing, Model studies.

Three methods of modeling acid mine drainage effects were discussed. A net alkalinity routing model was the simplest of these, but it can be potentially misleading. It typically overestimates the effect of acid sources on pH by neglecting carbon dioxide transfer to the atmosphere. Inclusion of a simple carbon dioxide transfer function can substantially reduce errors in stream quality prediction. A plug flow reaeration equation, coupled with mass balancing at mixing points in a stream network, provides modeling results comparable to those of more complex computerized solutions of chemical equilibrium equations. None of the models accounts for carbonate dissolution or oxidation and hydrolysis of ferrour iron. (Adams-ISWS)
W80-01652

MONITORING CHANGES IN GROUND WATER QUALITY,
H. LeGrand.
Water Well Journal, Vol 33, No 6, p 53-56, July, 1979. 2 Fig.

Descriptors: *Ground water, *Water quality, *Monitoring, Observation wells, Tracers, Locating, Depth, Ground water movement, Pollutants, Migration, Attenuation, Planning, Model studies, Hydrogeology, Economics, Path of pollutants.

Ground water of acceptable quality is commonly in contact with water of inferior quality. Simple and economic methods of determining precisely the boundary zones between contaminated and uncontaminated water are not available. As a result, much reliance is placed on monitoring wells. Planning a monitoring program should be based on a preliminary evaluation of the hydrogeologic framework, mobility of particular contaminants, and man-made events causing movement of contaminated water. On this basis, proper location and depth of monitoring wells can be established. Tracers have limited value in determining the rate and direction of ground water and contaminant movement due to variations in hydrogeologic conditions along the path of movement. The need for monitoring will increase, but through technological improvements, monitoring can be minimized. One such improvement is a synthetic hydrogeologic model which can simulate the behavior of the contaminated water. Such a model, by using easily obtained data, will help to assess the need for monitoring and to conduct a monitoring program with optimum results where it is necessary. (Purdin-NWWA)
W80-01700

THE QUALITY OF GROUNDWATER IN CALIFORNIA,
California State Dept. of Water Resources, Sacramento.
J. M. Morris, Jr.
Pacific Groundwater Digest, Vol 2, No 9, p 7-13, September, 1979. 1 Fig.

Descriptors: *California, *Ground water basins, *Water quality, Geology, Climates, Urbanization, Saline water intrusion, Sewage disposal, Feed lots, Return flow.

Ground water quality in California's twelve hydrologic basins is described in terms of geologic, climatic, and manmade conditions. Major problems are high salinity due to arid climate, irrigation return flows, and seawater intrusion resulting from overdrafting, high nitrate levels due to urban and agricultural wastes, and high concentrations of specific minerals such as boron, sulfate, and arsenic due to local geologic conditions. (Purdin-NWWA)
W80-01734

PETROLEUM CONTAMINATION OF WELLS,
New York State Dept. of Health, Albany.
D. P. Ferguson.
Ground Water Age, Vol 14, No 1, p 67-74, September, 1979.

Descriptors: *Water wells, *Water pollution, *Oil, Gasoline, Storage tanks, Leakage, Location, Gas chromatography, Dyes, Tracers, Path of pollutants, Ground water movement, Drilling, Microbial degradation.

Petroleum products are persistent and highly mobile contaminants which are difficult to remove from ground water. Leakage from buried fuel tanks is the most common source of petroleum contamination of ground water. The exact location of abandoned tanks may not be known or more than one tank may be suspected. A hydrostatic test can be performed to determine if a particular tank is leaking. Gas chromatography is then used to identify the fuel in the ground water as the same as that in the leaking tank. However, this method may not be valid if the fuel changes consistency as it migrates through the soil or if a mixture of different brands of fuel is stored in the tank. Other methods are the use of dye tracers and contouring water table elevations to determine the direction of

ground water movement. Once contamination has occurred, the well owner has the options of using an activated charcoal filter to clean up the water, drilling the well deeper, or drilling a completely new well as far as possible from the source of contamination. an expensive method of removing petroleum involves microbial degradation. Several suggestions are offered to prevent petroleum contamination of wells. (Purdin-NWWA)
W80-01737

BIOSORPTION BY MARINE FISHES OF METHIANINE AND UREA DISSOLVED IN WATER,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
For primary bibliographic entry see Field 5A.
W80-01742

THE EFFECT OF DIMETHYL SULFATE ON THE REPRODUCTIVE SYSTEM OF THE LOACH, MISGURNUS FOSSILIS,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
For primary bibliographic entry see Field 5A.
W80-01743

EFFECT OF HEXACHLORANE (HCCH) ON SOME HEMATOLOGICAL AND BIOCHEMICAL CHARACTERISTICS OF THE BLOOD OF THE ROUND GOBY (GOBIUS MELANOSTOMUS),
Odessa State Univ. (USSR).
For primary bibliographic entry see Field 5A.
W80-01745

INFLUENCES OF DIELDRIN ON THE GROWTH AND BODY COMPOSITION OF FINGERLING RAINBOW TROUT (SALMO GAIRDNERI) FED OREGON MOIST PELLETS OR TUBIFICID WORMS (TUBIFEX SP.),
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5A.
W80-01746

METHYLATED ARSENIC FROM MARINE FAUNA,
Western Australia Dept. of Fisheries and Fauna, Perth. Marine Research Labs.
For primary bibliographic entry see Field 5A.
W80-01747

COPPER AND NUTRITION IN HELIX POMATIA (L.),
Innsbruck Univ. (Austria). Inst. fuer Zoophysiologie.
For primary bibliographic entry see Field 5A.
W80-01760

FACTORS AFFECTING THE FLUX OF ARSENIC THROUGH THE MUSSEL MYTILUS GALLOPROVINCIALIS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W80-01765

PELAGIC TAR CONCENTRATIONS IN THE GULF OF MEXICO OVER THE SOUTH TEXAS CONTINENTAL SHELF,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W80-01766

TOXICITY AND BIOCONCENTRATION OF EPN AND LEPTOPHOS TO SELECTED ESTUARINE ANIMALS,
Environmental Research Lab., Guld Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-01778

PETROLEUM IN DEEP BENTHIC ECOSYSTEMS OF THE GULF OF MEXICO AND CARIBBEAN SEA,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W80-01780

THE INFLUENCE OF DENSITY DIFFERENCES ON THE DISPERSION PROCESS IN SATURATED POROUS MEDIA,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2F
W80-01810

SOURCE AND LEVEL OF MERCURY IN A NEW IMPOUNDMENT,
Southern Illinois Univ. at Carbondale.
J. F. Meister, J. DiNunzio, and J. A. Cox.
American Water Works Association Journal, Vol 71, No 10, p 574-576, October 1979. 1 Fig, 3 Tab, 17 Ref.

Descriptors: *Water pollution sources, *Lakes, *Mercury, *Fish, *Illinois, Sampling, Chemical analysis, Pollutants, Path of pollutants, Soils, Water quality, Water pollution, Reservoirs, Impoundments, Water supply, *Cedar Lake(IL).

The souce of mercury in fish in a new impoundment was identified in this study as the inundated soil. The mercury in the soil was introduced into the food chain by direct uptake by microorganisms, rather than by a dissolution process; thus, the mercury level in fish is not indicative of the quality of the impoundment as a public water supply Moreover, an elevated mercury level in predatory fish in a new impoundment was found to be a predictable event. Because the soil, which now constitutes the lake bottom, was nearly depleted of mercury after only three years, the impoundment will be useful as a long-term recreational fishery as well as a public water supply. (Sims-ISWS)
W80-01813

DISPERSION IN STRATIFIED POROUS MEDIA: ANALYTICAL SOLUTIONS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W80-01824

ANALYTICAL NOTE--FLUORESCEIN TRACER TECHNIQUE FOR DETECTION OF GROUNDWATER CONTAMINATION,
Bender Hygienic Lab., Albany, NY.
S. Reznek, W. Hayden, and M. Lee.
Journal of the American Water Works Association, Vol 71, No 10, p 586-587, October 1979. 2 Tab, 2 Ref.

Descriptors: *Water pollution, *Groundwater, *Fluorescent dye, *Fluorescence, *Tracers, Analytical techniques, Methodology, Water pollution, Seepage, *Fluorescein.

Fluorescein is used to trace suspected seepage from a contaminated groundwater source. A detectable amount of fluorescein is added to the suspect source and then is monitored at a designated test point. Since the fluorescein can be lost by absorption or ion exchange in transit to the sampling point, the detection procedure must be as sensitive as possible. Described was a detection procedure to measure fluorescein by fluorometry as possible. Described was a detection procedure to measure fluorescein by fluorometry which is useful in tracing suspected seepage from a contaminated groundwater source. (Visocky-ISWS)
W80-01835

RUNOFF LOSSES OF SURFACE-APPLIED HERBICIDES AS AFFECTED BY WHEEL TRACKS AND INCORPORATION,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W80-01838

HYDROCARBONS IN BENTHIC ALGAE FROM THE EASTERN GULF OF MEXICO,
Gulf Coast Research Lab., Ocean Springs, MS.
For primary bibliographic entry see Field 5A.
W80-01844

TIDAL CURRENTS MEASURED NEAR A BRITISH COASTAL POWER STATION,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 2L.
W80-01850

SAMPLING PROGRAMS FOR EVALUATING UPLAND MARSH TO IMPROVE WATER QUALITY,
Florida Univ., Belle Glade. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W80-01852

NUTRIENT MOVEMENT IN STREAMFLOW FROM AGRICULTURAL WATERSHEDS IN THE GEORGIA COASTAL PLAIN,
Science and Education Administration, Tifton, GA
L. E. Asmussen, J. M. Sheridan, and C. V. Booram, Jr.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 809-815, 821, July-August 1979. 8 Fig, 6 Tab, 19 Ref.

Descriptors: *Nutrients, *Agricultural runoff, *Streamflow, *Georgia, Sampling, Surveys, Runoff, Water pollution, Pollutants, Path of pollutants, Watersheds(Basins), Water quality, Nitrogen compounds, Nitrites, Nitrates, Chlorides, Phosphorus, Phosphorus compounds, Precipitation(Atmospheric), Chemistry of precipitation, *Little River Watershed(GA)

Chemical load of nitrate-plus nitrate-nitrogen and orthophosphate-phosphorus in runoff from a complex cover agricultural watershed in the Georgia Coastal Plain was found to be less than the rainfall input of these chemicals. Chloride load in runoff exceeded chloride load in rainfall. Measured streamflow nutrient losses showed a rage in nitrate-plus nitrate-nitrogen load from 0.14 to 0.24 kg/ha/yr and a range in the orthophosphate-phosphorus load from 0.141 to 0.144 kg/ha/yr. (Sims-ISWS)
W80-01854

SIZING COMPONENTS ON OPEN FEEDLOT RUNOFF-CONTROL SYSTEMS,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering
For primary bibliographic entry see Field 5G.
W80-01855

ANALYTICAL PREDICTION OF NATURAL TEMPERATURES IN RIVERS,
Wyoming Univ., Laramie. Dept. of Mineral Engineering.
R. D. Noble.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Technical Note, p 1014-1018, October 1979. 11 Ref, 2 Append.

Descriptors: *Water temperature, *Rivers, *Forecasting, *Mathematical models, Natural streams, Model studies, Mathematics, Analytical techniques, Theoretical analysis, Water quality.

The objectives of this paper were: An analytical solution to the prediction of the natural temperature regime of a river. This solution includes transient, convective, and despersive effects, In many instances, dispersive effects are negligible. A simplified analytical solution was also presented for this case. The groundwater temperature of the water entering the headwaters was used as a

boundary condition at the upstream end. The natural temperature regime of a river was defined as the temperature regime in the absence of any man-made alterations. The alterations can come about from channelization, impoundments, forest cover removal, irrigation, and industrial discharges. Knowledge of the natural temperature regime can be of great value when dealing with any man-made alteration so as to determine the effect of the alteration on the ecology of the river. A theoretical mathematical model was presented which can predict the axial temperature profile of an entire river basin given the meteorological and flow conditions present. The only simplification is a linearization of the heat source term. A simplified model also was presented which can be used when axial dispersion is negligible. Both models use the temperature of the groundwater in the headwaters region as a boundary condition at the upstream end. (Humphreys-ISWS)
W80-01856

ANALYZING ENVIRONMENTAL TIME SERIES,
Waterloo Univ. (Ontario). Dept. of Systems Design.
F. D'Astous, and K. W. Hipel.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Proceedings Paper 14881, p 979-992, October 1979. 3 Fig, 6 Tab, 19 Ref, 2 Append.

Descriptors: *Time series analysis, *Water quality, *Model studies, Mathematical models, Stochastic processes, Data processing, Phosphorus, Pollutants, Flow, Rivers, Water pollution, Intervening models, Missing data.

Intervention analysis was utilized to determine the effectiveness of sewage treatment for reducing phosphorus levels in rivers. Because problems involving missing data were encountered, a data interpolating technique was devised using intervention analysis. Practical examples were given to illustrate the usefulness of this method as well as the advantages of employing intervention analysis for analyzing water quality data. (Sims-ISWS)
W80-01859

KALMAN FILTER MODELING OF THE SPEED RIVER QUALITY,
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
T. W. Constable, and E. A. McBean.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Proceedings Paper 14894, p 961-978, October 1979. 5 Fig, 2 Tab, 22 Ref, 1 Append.

Descriptors: *Water quality, *Water pollution, *Model studies, *Analytical techniques, Mathematical models, Filters, Sampling, Surveys, Estimating, Estimating equations, Rivers, Pollutants, Dissolved oxygen, Biochemical oxygen deand, Nutrients, Environmental engineering, Kalman filter.

The extended Kalman filter was applied to the results of two sampling surveys conducted on the Speed River, Ontario. Magnitudes of carbonaceous and nitrogenous BOD components for these surveys were determined. Parameter magnitudes were estimated using Rosenbrock's parameter estimation technique, and the measurement error of covariance matrix for each measurement vector was established. Filtered estimates of carbonaceous oxygen demand, nitrogenous oxygen demand, the dissolved oxygen deficit concentrations were obtained. In addition, the carbonaceous and nitrogenous BOD reaction rates, the carbonaveous BOD sedimentation rate, and the maximum daily rate of photosynthetic exygen production were estimated. The utility of the extended Kalman filter to use all available information coming from both the system model of the stream processes and measurements of the state variables to provide approximate minimum variance estimates of the state and confidence limits of these estimates was shown. (Sims-ISWS)
W80-01860

MATHEMATICAL MODELING OF DISSOLVED OXYGEN IN MIXED ESTUARIES,
Department of Local Government, Brisbane (Australia).
Y. F. Ozturk.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Proceedings Paper 14923, p 883-904, October 1979. 6 Fig, 3 Tab, 23 Ref, 1 Append.

Descriptors: *Dissolved oxygen, *Biochemical oxygen demand, *Model studies, *Mathematical models, *Australia, Rivers, Estuaries, Tidal waters, Nitrogen compounds, Nitrification, Ammonia, Nitrates, Reaeration, Water quality, *Brisbane Estuary(Australia).

One of the basic difficulties in modelling DO in a given estuary is the uncertainties involved in the BOD and reaeration rates. The oxidation of both carbonaceous and nitrogenous substances simultaneously and their representation by first-order kinetics may be justified in estuaries. The carbonaceous and nitrogenous BOD rate coefficients were determined from the standard BOD tests of estuary water samples by considering the two stages of BOD separately and by adjusting the time origin of nitrification stage. The available reaeration rate coefficient equations developed for nontidal systems and applied in modeling DO in tidal estuaries did not fully represent the tidal estuaries. A new reaeration rate coefficient equation was developed for tidal systems. The proposed equation was related to the dispersion coefficient and was a function of flow depth and four-thirds power of tidal velocity. (Sims-ISWS)
W80-01861

CALCULATING OVERFLOWS FROM COMBINED SEWER SYSTEMS,
Black and Veatch, Kansas City, MO.
For primary bibliographic entry see Field 5D.
W80-01862

A MODEL FOR NITRATE-NITROGEN TRANSPORT AND DENTRIFICATION IN THE RIVER THAMES,
Thames Water Authority, Reading (England), Thames Conservancy Div.
G. D. Thomson.
Water Research, Vol 13, No 9, p 855-863, 1979. 13 Fig, 3 Ref.

Descriptors: *Nitrates, *Rivers, *Model studies, Mathematical models, Nutrients, Nitrogen, Nitrogen compounds, Denitrification, Water pollution, Water pollution sources, Pollutants, Path of pollutants, On-site investigations, Data collections, Sampling, Water quality, *Thames River(England), *England.

A mathematical model describing the mass flow, including denitrification, of nitrate in the main river Thames has been developed. A three year period, including severe drought and flooding, was used to test the model. Good agreement was found between the nitrate concentrations observed at several sites on the river Thames and those calculated by the model. The model may be used to establish the sensitivity of nitrate levels in the Thames above intakes to changes in tributary inputs which could be affected by various management strategies. (Sims-ISWS)
W80-01863

PREVALENCE OF OILED PLUMAGE OF TERNS AND SKIMMERS ON WESTERN LONG ISLAND, NEW YORK: BASELINE DATA PRIOR TO PETROLEUM EXPLORATION,
Columbia Univ., New York. School of Public Health and Administration.
M. Gochfeld.
Environmental Pollution, Vol 13, p 123-130, 1979. 3 Tab, 24 Ref, Append.

Descriptors: *Baseline studies, *Oil pollution, *Water birds, Atlantic Ocean, New York, Oil, Water pollution effects, Oil spills, Offshore platforms, Ducks(Wild), Gulls, Oiled plumage, Petroleum exploration, *Terns.

Observations at Long Island seabird colonies during the period 1969 to 1978 revealed a more or less constant prevalence of oiling of less than 1% for adult common terns and nearly 2% for adult black skimmers. Oiling was usually light (12 on a scale of 5) and very few heavily oiled birds were seen either at the colonies or elswhere on Long Island's beaches. Currently oiling of seabirds on the Atlantic Coast of North America is not a widespread or serious problem compared with its prevalence on parts of the Pacific and Gulf Coasts of North America and in Europe. Data presented here provide a baseline for comparison with future years, since oil exploration began off Long Island during 1978 and large-scale exploitation is planned. (Deal-EIS)
W80-01864

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
F. L. Petrilli, G. P. De Renzi, R. P. Morelli, and S. De Flora.
Water Research, Vol 18, No 9, p 895-904, 1979. 2 Fig, 4 Tab, 20 Ref.

Descriptors: *Water pollution, *Industrial wastes, *Sewage, *Surveys, Monitoring, Pollutants, Path of pollutants, Water pollution sources, Aerial photography, Sampling, Chemicals, Bacteria, Pathogenic bacteria, Viruses, Coliforms, E. coli, Streptococcus, Sediments, Microbiology, *Tyrrhenian Sea.

Investigations were carried out in a coastal area of the Tyrrhenian Sea, which receives wastes from a chemical manufacturing industry. Industrial wastes are conmbined with domestic sewage prior to discharge into the sea. Warm and alkaline wastewaters carry large amounts of whitish suspended solids, mainly composed of calcium carbonate, calcium sulphate, and magnesium hydroxide, which are responsible for an evident visual pollution of the sandy shore and of the facing seawater body. Alterations of physical parameters (temperature and pH values) were found to affect the investigated coastal area only to a limited extent. Conversely, aerial photographic investigations afforded a more complete picture of pollution spreading. Infrared and chiefly water-penetration images provided information on the underwater environment, and the resulting findings could be correlated with the particle size analysis of sediment samples. Fecal streptococci represented a considerable proportion of total heterotrophic bacteria in waste and seawater, whereas concentration of total and fecal coliforms was relatively low. These figures suggested a possible selective inactivation of bacteria in industrial waters, which was supported by the findings of survival tests with three bacterial species (E. coli, Strep. faecalis, and S. typhi). Survival of a virus (type 1 polio-virus) and of a virus antigen (hepatitis B surface antigen or HBsAg) was also investigated under various conditions. (Sims-ISWS)
W80-01865

DIFFERENTIAL TRACING OF OILY WASTE AND THE ASSOCIATED WATER MASS BY TAGGING WITH RARE EARTHS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
D. L. McCown.
Water Research, Vol 13, No 11, p 1065-1076, 1979. 8 Fig, 3 Tab, 14 Ref.

Descriptors: *Path of pollutants, *Oil wastes, *Tracers, *Lake Michigan, Effluents, Water pollution sources, Water pollution, Tracking techniques, Oil spills, Currents(Water), Pollutants, Sampling, Mixing, Dispersion, Water quality, Harbors, Industrial wastes, Rare earths.

A method was developed for tagging oily waste with dysprosium and the associated freshwater with samarium. Neutron activation analysis permitted determination of rare earth concentrations as low as 40 ng/l in 15-ml water samples. Shipboard sampling procedures were developed that allowed measurement of the three-eimensional distribution

of the spreading wastes and associated water. The method was applied in two field experiments that involved tracing oily wastes and polluted water from the Indiana Harbor Canal (IHC) into Lake Michigan. For a summer, floating-plume experiment, about 1400 shipboard samples were collected. Employment of the dual-tracer technique led to the following results: (1) after artificial mixing into the water column by a passing ship, the tagged oil did not immediately resurface; and (2) there were no distinguishable differences between the movement of the oil andwater over 4 km of travel. During a winter, sinking-plume experiment, 1200 lake-water samples were collected from a boat and from the raw-water intakes of Chicago's South Water Filtration Plant (SWFP). These data provided positive evidence of the intake of IHC effluent and oily waste at the SWFP. The different tracers for the oily waste and underlying water gave evidence of separate pathways to the SWFP, reflecting differing transport modes for surface and near-bottom waters. (Sims-ISWS)
W80-01866

SUSPENDED SEDIMENT-PHOSPHORUS RELATIONSHIPS FOR THE INFLOW AND OUTFLOW OF A FLOOD DETENTION RESERVOIR,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
J. D. Schreiber, and D. L. Rausch.
Journal of Environmental Quality, Vol 8, No 4, p 510-514, October-December 1979. 3 Fig, 5 Tab, 15 Ref.

Descriptors: *Sediments, *Suspended solids, *Phosphorus, *Reservoirs, Runoff, Agricultural runoff, Erosion, Watersheds(Basins), Flood control, Nutrients, Inflow, Discharge(Water), Water chemistry, Sampling, Data processing, Pollutants, Path of pollutants, Water pollution, Water quality.

Callahan Reservoir, located in an agricultural area near Columbia, Missouri, was studied for 3 years to determine the inflow and outflow suspended sediment phosphorus (P) and the solution P relationships. During the study, the mean inflow solution ortho-P concentration was 0.085 mg/liter as compared with 0.041 mg/liter for the outflow. Concentrations of ortho-P were highest in both the inflow and outflow during the fall and winter. As yearly suspended sediment concentrations decreased in both the inflow and outflow, due to lower runoff and sediment yields, solution ortho-P, as well as sediment total, inorganic, organic, and exchangeable P concentrations, increased. Similarly, as a result of coarse sediment deposition within the reservoir during individual storm events, outflow sediments were enriched in clay and had higher concentrations of total, inorganic, organic, and exchangeable P than inflow sediments. However, because of sediment deposition within the reservoir, outflow volume concentrations of sediment total P decreased fourfold as compared with inflow sediments. (Sims-ISWS)
W80-01872

CONTAMINATION OF GREAT SMOKY MOUNTAINS TROUT STREAMS BY EXPOSED ANAKEESTA FORMATIONS,
Western Carolina Univ., Cullowhee, NC. Dept. of Chemistry.
J. R. Bacon, and R. P. Maas.
Journal of Environmental Quality, Vol 8, No 4, p 538-543, October-December 1979. 4 Fig, 3 Tab, 18 Ref.

Descriptors: *Pyrite, *Environmental effects, *North Carolina, *Acid streams, *Water pollution sources, *Roadbanks, Acidic water, Leachate, Heavy metals, Geologic formations, Manganese, Zinc, Rock excavation, Water pollution, Acid streams, Sulfides, On-site investigations, Roads, *Great Smoky Mountains National Park, Anakeesta formations.

Anakeesta formations, prevalent geologic deposits in the Great Smoky Mountains National Park (GSMNP), when exposed to air and water, release an acid and heavy metal containing leachate into several GSMNP streams, renderin them virtually lifeless. Anakeesta pyrite affecting Beech Flats Creek was exposed during the construction of U.S. Highway 441, while exposures affecting Alum Cave Creek and Walker Prong are naturally occurring. The road cut on U.S. 441 at Beech Flats Creek acts as point source of various contaminants. The acidity increases 100-fold (pH 6.7 to 4.7) in the several hundred meters where the stream flows through a road cut fill area. Manganese and zinc were the main metallic ions introduced at the road cut. The zinc increased from 6 to nearly 200 ppb, and the manganese increased from an undetectable level to over 250 ppb. Seasonal variations below the road show a high concentration near 500 ppb in the summer to a low concentration near 100 ppb in the winter for both manganese and zinc. Both manganese and zinc showed the dilution effect expected going downstream away from the road cut. Alum Cave Creek and Walker Prong showed much lower levels of manganese and zinc and no point source could located. (Visocky-ISWS)
W80-01873

A MASS BALANCE STUDY OF APPLICATION OF MUNICIPAL WASTE WATER TO FORESTS IN MICHIGAN,
Michigan State Univ., East Lansing. Inst. of Water Research.
T. M. Burton, and J. E. Hook
Journal of Environmental Quality, Vol 8, No 4, p 589-596, October-December 1979. 4 Fig, 5 Tab, 31 Ref. EPA R005143-01

Descriptors: *Waste water disposal, *Forests, *Nutrients, On-site investigations, Deciduous forests, Nitrogen, Nitrogen compounds, Nitrates, Phosphorus, Chlorides, Sodium, Denitrification, Pollutants, Path of pollutants, Leaching, Irrigation, Evapotranspiration, Runoff, Recharge, Precipitation(Atmospheric), Water balance.

A mass balance study of the effects of secondary municipal wastewater on phosphorus and nitrogen cycling was conducted in 1976 and 1977 on three 1.2-ha plots in a late successional, sugar maple forest in southern Michigan. The treatments included an unirrigated control plot and 5- and 10-cm/week wastewater application plots. The 10-cm/week site was deliberately overloaded hydraulically. Chloride concentrations at the 150-cm depth on the wastewater application plots did not approach input concentrations until the end of the 1976 irrigation season. Thus, 1977 data were emphasized in mass balance calculations. About 96% of the added inorganic nitrogen from 5 cm/week of wastewater application leached past the root zone. Application of 10 cm/week wastewater increased inorganic nitrogen 'retention' on a mass balance basis to 69% of input apparently as a result of denitrification under anaerobic conditions in the water-logged soils. However, the 10-cm/week application resulted in nitrate concentrations approaching those of wastewater input concentrations during peak runoff periods. The 10-cm/week application also resulted in death of trees in the lower areas of the forest where water tended to pool. Phosphorus retention by the system was 96.5% at an application rate of 5 cm/week but decreased to 66% when the irrigation rate was increased to 10 cm/week as a result of runoff losses. Changes in soils included increases available phosphorus and exchangeable magnesium and potassium in the top 15 cm of soil and increased sodium and chloride concentrations throughout the 150-cm depth sampled. (Sims-ISWS)
W80-01875

DETERMINATION OF AQUIFER TRANSPORT PARAMETERS,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie.
For primary bibliographic entry see Field 2F.
W80-01877

HEAT RECIRCULATION INDUCED BY THERMAL DIFFUSERS,
Delaware Univ., Newark. Dept. of Civil Engineering.
J. H. W. Lee, G. H. Jirka, and D. R. F. Harleman.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY10, Proceedings Paper 14929, p 1219-1231, October 1979. 7 Fig, 1 Tab, 4 Ref, 2 Append.

Descriptors: *Heat, *Heat balance, *Heat transfer, *Bodies of water, Recirculated water, Entrainment, Environmental engineering, Water cooling, Temperature, Electric powerplants, Thermal pollution, Momentum transfer, Hydraulics, Design, Model studies, Flow field, Diffusers, Dissipation.

A unidirectional, multiport, thermal diffuser discharges large quantities of condenser cooling water in the form of a line of turbulent heated jets near the bottom of the receiving waterbody. The large momentum input induces a large mixed flow compared with the discharge flow, causing rapid temperature reduction within a relatively small area. This paper presented the results of an experimental study which demonstrates that under certain conditions the large back entrainment demand coupled with momentum dissipation (due to bottom friction) of the diffuser plume may generate recirculation of the mixed flow back into the near field, leading to temperatures significantly higher than previously predicted. Length and time scales of recirculation are estimated: the transient maximum temperature rise is correlated with the length scale of recirculation and the sink strength. (Viscosky-ISWS)
W80-01879

TIDAL AND SEASONAL VARIATIONS OF TRACE ELEMENTS IN TWO CORNISH ESTUARIES,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2L.
W80-01884

SEDIMENT HYDROCARBONS NEAR AN OIL RIG,
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.
T. F. Lytle, and J. S. Lytle.
Estuarine and Coastal Marine Science, Vol 9, No 3, p 319-330, September 1979. 3 Fig, 5 Tab, 42 Ref.

Descriptors: *Sediments, *Organic compounds, *Water pollution, *Coasts, *Texas, Aromatic compounds, Sampling, Analytical techniques, Analysis, On-site investigations, Chemical analysis, Gas chromatography, Water pollution sources, Oil, Coastal structures, Environmental impact studies, Oil rig, Olefins, Aliphatic hydrocarbons.

Sediment samples were collected from 25 strategic locations at a site on the Texas shelf before emplacement of an exploratory oil rig, during drilling, and after the rig had been in place for 2 months. These sediments were analyzed for aliphatic and aromatic hydrocarbons, and 13 gas chromatographic parameters, used in assessing pollution, were calculated. Graphic cluster analysis, analysis of variance, and discriminant analysis were applied to these parameters to view changes as well as to evaluate the effectiveness of gas chromatographic data in monitoring sediment hydrocarbons. Changes discernible by these techniques were slight but more noticeable at stations close to the rig. Hydrocarbons in the C14 to C30 region of the aliphatic chromatograms were in low abundance in all samples but consisted mostly of n-C17 and C25 branched-chain olefins. The high molecular weight region contained high concentrations of the odd carbon numbered n-alkanes with a predominance of n-C29. This similarity to terrestrial hydrocarbons was further confirmed by a mean delta C13 value vs. PDB of -28.0 parts per thousand for the aliphatic hydrocarbons. (Humphreys-ISWS)
W80-01885

WINTERTIME RAW-WATER CONTAMINATION AT CHICAGO'S SOUTH WATER FILTRATION PLANT,
Argonne National Lab., IL.
W. Harrison, D. L. McCown, K. D. Saunders, and J. D. Ditmars.
Journal of the Water Pollution Control Federation,

Vol 51, No 10, p 2432-2446, October 1979. 7 Fig, 3 Tab, 16 Ref.

Descriptors: *Illinois, *Water supply, *Lake Michigan, *Water pollution, On-site investigations, Water pollution sources, Tracers, Tagging, Samarium, On-site data collections, Path of pollutants, Analytical techniques, Analysis, Winter, Winds, Water temperature, Rainfall, Currents(Water), Lakes, *Chicago(IL).

The chief contributor to water pollution at the intakes for Chicago's South Water Filtration Plant is effluent from the Indiana Harbor Canal, Transported northward as a sinking plume by coastal currents in southwestern Lake Michigan. Canal water was injected with a complexed rare earth element, samarium. Subsequent samples containing the element provided unequivocal evidence for transport and mixing of the entire canal effluent, for the environmental conditions during the experiment, indicates a minimum dilution of 2.8 in the plume offshore of the treatment plant and 130 and greater than 100,000 at the shore and crib intakes, respectively. The worst-case potential pollution event was calculated from wind and rainfall. (Humphreys-ISWS)
W80-01886

GREAT LAKES TOTAL PHOSPHORUS BUDGET FOR THE MID 1970S,
National Oceanic and Atmospheric Administration, Ann Arbor, MI.
S. C. Chapra, and W. C. Sonzogni.
Journal of the Water Pollution Control Federation, Vol 51, No 10, p 2524-2533, October 1979. 2 Fig, 6 Tab, 37 Ref.

Descriptors: *Great Lakes, *Lake Erie, *Lake Ontario, *Lake Michigan, *Lake Huron, *Lake Superior, *Mathematical models, *Phosphorous, Nutrients, Water pollution, Water quality, Data collections, Model studies, Annual, Analytical techniques, Analysis, Systems analysis, Phosphorous budget, Sediment losses.

A mathematical model was used to synthesize recent information on the major fluxes of total phosphorus within the Great Lakes system. The model, which uses an annual time frame, consists of a coupled set of algerbraic equations representing material balances of the sources and sinks of total phosphorus for the major segments of the Great Lakes. The magnitude of sediment losses and intersegment effects were investigated by mathematical manipulations of the model. The latter demonstrates the impact of Detroit River loadings on the phsophorus levels of Lakes Erie and Ontario and generally shows that, because of the interdependence of its parts, the Great Lakes must be viewed from a system's perspective rather than as a series of individual, isolated entities. The consequence of such a perspective to water quality management is that uniform treatment of sources, while convenient from a political or legal standpoint, is economically suboptimal. (Humphreys-ISWS)
W80-01887

NUMERICAL SIMULATION OF GAS FLOW IN SANITARY LANDFILLS,
Stanford Univ., CA. Dept. of Civil Engineering.
A. N. Findikakis, and J. O. Leckie.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Proceedings Paper 14896, p 927-945, October 1979. 8 Fig, 1 Tab, 24 Ref, 1 Append.

Descriptors: *Model studies, *Landfills, *Gases, *Migration, *Municipal wastes, Numerical analysis, Porous media, Methane, Carbon dioxide, Nitrogen, Air-earth interfaces, Anaerobic bacteria, Leachate, Organic acids, Wastes, Stabilization, Equations, Biodegradation, Gas flow, Gas production, Finite-difference method.

The stabilization of refuse placed in sanitary landfills and the quality and rate of production of gases in landfills are principally the result of complex biological processes. A numerical model has been developed for simulating one-dimensional flow of a mixture of methane, carbon dioxide, and nitrogen through sanitary landfills. Finite-difference approximations to the differential gas flow equations were derived with an implicit time stepping scheme. The nonlinear finite-difference equations were solved iteratively using the Newton-Raphson method. An explicit formulation was also explored, the time step size required for stability was prohibitively small. The boundary condition at the landfill-air interface includes the assumption that the total pressure cannot drop below atmospheric pressure within a thin layer at the top of the landfill cover. The model was applied to data from two recent landfills. The pressure and concentration profiles predicted by the model are close to field observations. (Visocky-ISWS)
W80-01895

TARP GROUNDWATER MONITORING, SUMMARY REPORT (OCTOBER, 1976-SEPTEMBER, 1977),
Metropolitan Sanitary District of Greater Chicago, IL. Research and Development Lab.
B. Washington, and A. W. Obayashi.
Report No 78-9, June 1978. 36 p, 4 Fig, 2 Tab, 4 Ref, 1 Append.

Descriptors: *Groundwater, *Monitoring, *Illinois, *Water quality, Observation wells, Biochemical oxygen demand, Coliforms, Water pollution, Water sampling, Water properties, On-site investigations, On-site data collections, Hydrogen ion concentration, Chlorides, Hardness(Water), Mercury, Alkalinity, Phosphorus, Phenols, Conductivity, Chemical oxygen demand, Suspended solids, *Chicago(IL), Fecal coliform, Cyanide.

The Metropolitan Sanitary District of Greater Chicago is presently in the process of implementing its Tunnel and Reservoir Plan (TARP) to eliminate pollution of the waterways and local flooding in the Chicago land area. Since October, 1976, a series of 18 monitoring wells have been regularly sampled for indications of pollution. Four of these wells are located adjacent to the existing Southwest-13A tunnel in suburban McCook and provide information relative to the effect of TARP on groundwater quality in the general vicinity of this tunnel segment. The remaining wells are located adjacent to proposed tunnels (and the Summit-McCook reservoir) and provide baseline data characterizing the present groundwater quality in the respective areas. The data obtained from the 4 Southwest-13A monitoring wells from October, 1976, through September, 1977, showed no incidence of pollution attributable to combined sewer overflows being conveyed in the tunnel. Key pollution indicators (BOD and fecal coliform counts) have been consistently low (averaging 1 mg/l BOD and less than 1 fecal coliform organism/100 ml of sample, respectively), even during periods of relatively high water levels in the tunnels when significant tunnel exfiltration may occur. (Humphreys-ISWS)
W80-01896

THE EFFECTS OF TOLUENE ON EMBRYOS AND FRY OF THE JAPANESE MEDAKA ORYZIAS LATIPES WITH A PROPOSAL FOR RAPID DETERMINATION OF MAXIMUM ACCEPTABLE TOXICANT CONCENTRATION,
State Univ. of New York Coll. at Brockpost. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-01922

SECONDARY SALINIZATION AND SODICATION IN EGYPT: A CASE STUDY,
Alexandria Univ. (Egypt). Dept. of Soil and Water Science.
M. M. El-Gabaly.
Water Supply and Management, Vol 3, No 3, p 179-199, 1979. 6 Tab, 26 Ref.

Descriptors: *Saline soils, *Alkaline soils, *Salinity, *Soil management, *Water management(Applied), *Saline water, Asessments, Land management, Water table, Root zone, Salt balance, Irrigation canals, Leaching, Water quality, Soil chemical properties, Irrigation water, Farm management, Drainage, Monitoring, Egypt.

The development of secondary salinization and sodication in arid Egypt involves both natural and man-made factors including soil, climate, water, and management. The present review, aiming at a better assessment of land resources affected by secondary salinization are identified as poor levelling, fallowing, cropping patterns, insufficient leaching, and formation of a plowsol layer resulting from repeated tillage at a given depth. Procedures and programs are recommended to alleviate the problem of secondary salinization (2) changing surface and root zone salinity, (3) establishing a salt balance within a given area, (4) creating changes in micro-relief, (5) reducing seepage from water courses and adjacent land, (6) monitoring soil productivity, and (7) monitoring changes in the salinity of irrigaion canals. (Tickes-Arizona)
W80-01954

5C. Effects Of Pollution

WATER POLLUTION CONTROL IN THE REPUBLIC OF CHINA,
Taiwan Water Resources Planning Commission, Taipei.
L. T. Hsueh.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, Feb. 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Pergamon Press Inc. in U.S.A. Asian Institute of Technology, Bangkok, Thailand, p 3-7. 1 Tab.

Descriptors: *Water pollution control, *Republic of China, *Developing countries, Damages, Effects, Legislation, Industrial wastes, Domestic wastes, Physical features, Programs, Executive agencies.

Presented is a country report of water pollution control in the Republic of China. Owing to population increase, rapid growth of industry and expansion of urbanization, the extent of water pollution ranges from moderate to serious along the downstreams of most rivers in Taiwan. The main sources of pollution are industrial and domestic wastes. This paper reviews the physical features, present status of water pollution, damage caused by pollution, and control measures including legislation, the work of executive agencies and control programs implemented so far. (Bell-Graf--Cornell)
W80-01608

AN INVESTIGATION OF PROPOSED EFFLUENT DISCHARGE INTO A TROPICAL MANGROVE ESTUARY,
Department of Construction, Phillip (Australia).
D. A. Henley.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc. in USA), p 43-64, 1978. 1 Fig, 11 Tab, 5 Equ, 1 Ref.

Descriptors: *Effluents, *Discharge(Water), *Mangroves, *Estuaries, *Environmental effects, *Tropical regions, Oceanography, Pollutants, Lagoons, Sediments, Phosphorus, Nitrogen, Foliage, Equations, Statistical methods, Dispersion coefficient, Mass balance, Tides, Mixing, Nutrient status, Darwin(Australia).

Described are environmental studies carried out to determine the likely effects of effluent discharge into a mangrove-fringed estuary at Darwin in northern Australia. The oceanographic studies are described together with the statistical method used to calculate likely buildup of pollutants within the estuary. Studies of the nutrient status of the mangroves, including their sediments, are also described. They were used to assist in determining likely effects on the mangroves of an increase in nutrient. It was concluded that effluent from a primary-secondary lagoon system could safely be discharged within the mangrove areas with no detrimental effect. (Bell-Graf--Cornell)
W80-01613

INTEGRATED APPROACH TO POLLUTION CONTROL SURAT, INDIA: A CASE STUDY,
S. V. Regional Coll. of Engineering and Technology, Surat (India). Department of Civil Engineering.
R. N. Shelat, S.N.V Vashi, and S.N.V. Subbayya.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology Bangkok, Thailand (Pergamon Press Inc. in USA), p 111-116, 1978. 1 Fig, 2 Tab.

Descriptors: *Effects, *Urbanization, *Environmental control, *Surveys, *Pollution abatement, *Developing countries, *Surat(India), Air pollution, Water pollution, Solid wastes, Planning, Urban development, Density patterns, Pollution levels.

The importance of environmental quality in a developing country such as India has recently attracted a great deal of interest. Water, air and land, the vital resources of life, are incresingly being polluted in the wake of population growth, industrialization and urbanization in developing countries. The study reported herein has been carried out by conducting short-term air, water and land pollution serveys of Surat, India to establish the current levels of pollution. An attempt has been made to show the relationships between density patterns and pollution levels, and between unplanned and planned urban development and pollution levels, thus emphasizing integrated planned development as a preventive measure for arresting pollution levels in fast-growing urban centers. (Bell-Graf-Cornell)
W80-01619

STRUCTURAL DESIGNS AND PROBLEMS FOR WATER POLLUTION CONTROL,
Irrigation Commission, Lucknow (India).
A. C. Chaturvedi.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, V.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 117-121, 1978. 11 Ref.

Descriptors: *Structural design, *Water pollution control, *India, *Developing countries, *Effects, Water quality, Groundwater, Waste water(Pollution), Management, Benefits, Measurement, Industrial disposal, Modeling, Optimization, Separation, Dilution.

Eighty percent of the villages in India suffer from the lack of safe drinking water facilities and most of India's population is exposed to serious pollution hazards. Methods of pollution control have to be constantly reviewed and practical aplications are being sought in physical modeling and computer simulation in environmental problems related to river, lake and marine ecosystems, water resources and pollution, and air quality and pollution dispersion--all in the context of urban and regional development. Incidents of pollution dispersion--all in the context of urban and regional development. Incidents of pollution which occur in varying degrees of severity either during construction or in operation are not complicated by the use of new construction materials. However, unexpected incidents and more complex design forms have complicated the straight-forward demands of safety requirements. Some of the major factors that affect the pollution of modern structures are discussed. (Bell-Graf--Cornell)
W80-01620

THE ROLE OF NUTRIENTS AND THEIR EFFECTS ON THE BIOTA IN FRESHWATER LENTIC SYSTEMS,
North Eastern Hill Univ., Shillong (India). Dept. of Zoology.
J. R. B. Alfred, S. Kaur, and M. P. Thapa.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand, (Perfamon Press Inc. in USA), p 133-139. 1978. 4 Tab, 17 Ref.

Descriptors: *Nutrients, *Effects, *Freshwater, *Lenthic environment, *Ponds, *Oligotrophy, *Eutrophication, *Seasonal, Phytoplankton, Zooplankton, Sampling, Water pollution, Adaphic factors, Allochthonous materials, Autochthonous materials, Pisciculture.

Critical edaphic factors and the role of allochthonous and autochthonous materials in the seasonality of nutrients are inadequately assessed with particular reference to organic production in water bodies at higher altitudes. This study attempts to reveal the effects of nutrients in two ponds, one of which is fertilized for pisci-culture and the other a natural oligotrophic system. The biotic seasonality, with reference to abiotic factors operating at these extreme conditons, was studied. An experimental study under natural conditions has not only a pronounced academic perspective, but also an immediate applicability - in particular, to the role of nutrients and their effects on pollution. The seasonality of phytoplankton, the presence of only certain species, and their effects on pollution. The seasonality of phytoplankton, the presence of only certain species, and their succession are discussed, and an overall analysis elucidates the different stages of pollution. (Bell-Graf--Cornel l)
W80-01622

BENTHIC MACROINVERTEBRATE AND FISH AS BIOLOGICAL INDICATORS OF WATER QUALITY, WITH REFERENCE TO COMMUNITY DIVERSITY INDEX,
Taiwan Water Pollution Control Agency, Taichung,
C. D. Lee, S. B. Wang, and C. L. Kuo.
In: Water pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Editedby E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 233-238, 1978. 1 Tab, 14 Ref.

Descriptors: *Water quality, *Benthic animals, *Fish, *Invertebrates, *Biological indicators, *Community diversity index, Waste water(Pollution), Streams, Environmental effects, Evaluation, Rivers, Downstream, Upstream, Developing countries, Taiwan(China).

The community diversity index of benthic macroinvertebrates and fish can be an efficient and effective tool for quantifying the impact of wastewater pollution on stream environments. The full-scale evaluation of stream environments can be more accurately determined if indicator organism systems are applied to facilitate water quality assessments. Examples of proper indicator organisms are: Hydropsyche formosae, Neoporla sp., Eubrianax sp., Sigara sp., Acheilognathus himontegus, Rhinogobius similis, Pseudogobio brevirostris, Zacco temmincki, Caridina denticula, Macrobrachium asperulum, Macrobrachium japonicum, Thiara granifera, Gambusia patruelis, Tilapia mossambica, Eriocheir japonicus, and Ophidonais sp. In terms of biological assessment, almost all the upstream parts of 15 major rivers in western Taiwan have good water quality for aquatic life. However, half of the downstream parts of these rivers have been exposed to moderate or even heavy contamination. (Bell-Graf--Cornell)
W80-01632

THE IMPORTANCE OF INDUSTRIAL EFFLUENT SURVEYS AND EFFECTS IN THE ECONOMICAL CONTROL OF WATER POLLUTION,
International Consulting and Lab. Services (England).
S. H. Jenkins, and R. K. Chalmers.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology Bangkok, Thailand (Pergamon Press in USA), p 287-305, 1978. 6 Fig, 8 Tab, 2 Ref.

Descriptors: *Industrial wastes, *Effects, *Surveys, *Water pollution control, *Economics, Effluents, Environment, Methodology, Combined sewers, Treatment facilities, Industries, Activated sludge, Estuaries, Data collection, Pollution load, Lagoon of Venice, Chemical concentrations, Toxicants, Developing countries.

A number of Western countries have foregone environmental protection in the past in favor of industrial development. It is only recently that they have realized the significance and necessity of environmental protection. The same trend could be found in developing countries where industry has been established firmly before the government tries to consider pollution problems; case studies in Europe on the need of intensive industrial effluent surveys and its significance on economic development have been reviewed and the applicability of the methodology and techniques to developing countries is discussed. Considered are: (1) the importance of eliminating toxicants from combined sewage and industrial effluent treatment systems; (2) investigating the load due to industry in a sewage treatment plant dominated by industrial wastes; (3) pollution control in the lagoon of venice; (4) method of survey to obtan data for a predictive model of a polluted estuary; and (5) estimating the cost of comprehensive water pollution studies. (Bell-Graf--Cornell)
W80-01637

WASTEWATER RECOVERY--OBJECTIVES AND MEANS,
Taylor (John) and Sons, London (England).
D. G. M. Roberts.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 309-314, 1978.

Descriptors: *Waste water(Pollution), *Reuse, Industrial water, Agricultural reuse, Indirect reuse, Health risks, Effluents, Standards, Purification processes, Amenity, Fish farms, Unpurified sewage, Sludge.

Wastewater reuse can substantially reduce a region's net abstraction of water. Direct reuse by agriculture or industry requires careful control and standby disposal arrangements. All effluents contain some pathogens and measures must be taken to reduce the health risks to operatives and consumers. Acceptable effluent standards are proposed and suitable treatment processes described. Reuse for amenity and in fish farms, indirect reuse, the dangers of reusing crude sewage and the utilization of liquid or dewatered sludge are considered. Situations where reuse is being practiced and the administrative requirements for effective reuse are described. (Bell-Graf--Cornell)
W80-01638

COMPOSITING OF CENTRIFUGED SLUDGE CAKE,
Japan Sewage Works Agency, Saitama. Technology Development Div.
A. Sugiki.
In: Water Pollution Control in Developing Countries. Proceedings of the International, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 697-700, 1978. 1 Tab, 3 Fig.

Descriptors: *Sludge, *Solid wastes, *Sewage, *Composting process, *Heavy metals, *Experiments, Agriculture, Rice, Barley.

This paper investigates the optimum conditions of the sewage sludge composting process and concentrations of heavy metals in sewage sludge. Experiments showed that: (1) after 1 or 2 days, the temperature of sewage sludge rose to 70C when moisture concentration was well controlled--good

results were obtained after about one week of fermentation and one month of curing; (2) the heavy metal concentrations in sludge cakes produced at domestic sewerage treatment plants were found to be within the standard level (Cd<=5, Hg2<=, As<=50 mg/kg on dry base). (Bell-Graf--Cornell)
W80-01672

SOME PUBLIC HEALTH ASPECTS OF LEACHATE FROM LANDFILLS,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5E.
W80-01676

LEVEL-B MULDUAL-PURPOSE DETENTION BASINS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 4A.
W80-01679

ASSESSMENT OF THE ENVIRONMENTAL INFRASTRUCTURE REQUIRED BY LARGE PUBLIC AND PRIVATE INVESTMENTS,
Harvard Univ., Cambridge, MA. Dept. of City and Regional Planning.
M. Shapiro, D. F. Luecks, and J. Kuhner.
Journal of Environmental Management, Vol 7, No 2, p 157-176, September 1978. 7 Tab, 2 Fig, 12 Ref.

Descriptors: *Water resources, *Sewage, *Assessment, *Environmental effects, *Economic impacts, *Investment, *Cross-Florida Barge Canal, *Secondary impacts, Planning, Capital, Projects, Methodology, Forecasting, Mathematical models, Treatment facilities, Systems analysis, Fiscal impact, Infrastructure costs, Population projections, Disaggregation, Inventory.

Large capital projects, such as highways and barge canals, may induce significant residential, commercial and industrial growth. This paper discusses an approach for evaluating the infrastructure requirements of such secondary development. Issues considered include the level of detail and time horizon used in making projections, service area delineation, facility selection and staging, and the impacts of local and state government actions. The approach can be used to compute residual fluxes and to evaluate economic impacts such as changes in tax rates and user charges. The methodology is applied to assess certain of the secondary impact of the proposed Cross-Florida Barge Canal. A county-level aggregate economic forecasting model has been developed to assist in projecting the major economic and demographic trends in the canal region. (Bell-Graf-Cornell)
W80-01699

STATISTICAL METHODS USED TO ASSESS BIOLOGICAL IMPACT AT NUCLEAR POWER PLANTS,
Battelle Pacific Northwest Labs. Richland, WA. Ecosystems Dept.
J. M. Thomas, J. A. Mahaffey, K. L. Gore, and D. G. Watson.
Journal of Environmental Management, Vol. 7, No. 3, p 269-290, November 1978. 6 Fig, 7 Tab, 21 Ref.

Descriptors: *Statistical methods, *Assessment, *Environmental effects, *Nuclear powerplants, Analytical techniques, Mathematical models, Simulation analysis, Regression analysis, Ecology, Statistical models.

This paper illustrates and discusses a number of analytical procedures used to assess ecological impact studies conducted at three nuclear power stations. The advantages, disadvantages and limitations of each statistical procedure are discussed. It is suggested that use of one of these procedures, accompanied by a field design based on the same statistical model and field methods recommended by other studies, will be suitable for the detection of changes in biota. However, since litigation has been directed to the question of effects on future populations, a plan for conducting environmental monitoring studies is devised in which that question is addressed. (Bell-Graf--Cornell)
W80-01701

ON THE PRODUCTIVITY AND CHEMICAL COMPOSITION OF SOME BENTHIC ALGAE IN HARD-WATER STREAMS,
C. Muller.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1457-1462. 1 Fig, 4 Tab, 14 Ref.

Descriptors: *Running waters, *Primary productivity, *Aquatic algae, *Chemical analysis, *Photosynthesis, Productivity, Rivers, Biomass, Chlorophyll, Cladophora, Lotic environment, Hardness(Water), Chlorophyta, Sweden.

Estimated approximate maximum specific photosynthetic rate for Cladophora is 5.94, for Vaucheria, 2.16, and for Lemanea, 45.6 mg O2/mg chlorophyll-a hr, indicating high productivity; however, the importance of Lemanea in the ecosystem might be limited since it disappears when the water temperature reaches a certain level. This paper estimates productivity of three representative algal communities from some hard-water streams in southern Sweden. Samples of Vaucheria sp. (River Tolangaan), Cladophora glomerata (River Trydean), and Lemanea fluviatilis (River Verkean) were collected in August-October 1976. The standing crop of Cladophora and Lenmanea were much higher than the standing crop of Vaucheria per sampling area bases. The ash content of Lemanea was low, 3-5%, and calcium and iron contents below 0.5%. In Cladophora and Vaucheria, the ash content was 20-25%, mainly due to calcium carbonate deposits. The potassium content was high, ranging 1-2%. The chlorophyll content of Lemanea was only 61.2 micro g sq dm when maximum biomass occurred, about one-tenth the maximum Cladophora chlorophyll content. As the experiments were run under laboratory conditions, the values were thought to reflect potential algal productivity. Cladophora showed highest gross production values in September with 0.630 mg O2/hr/g Fw and Vaucheria the lowest gross production values in October, 0.069 mg O2/hr/g Fw. The net productivity of Vaucheria was below zero, indicating respiration predominating over production. (Danovich-Wisconsin)
W80-01703

ROLE OF THE ORGANIC LAYER ON STONES IN DETRITAL METABOLISM IN STREAMS,
Umea Univ. (Sweden). Dept. of Ecological Zoology.
U. Karlstrom.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1463-1470. 5 Fig, 3 Tab, 15 Ref.

Descriptors: *Rivers, *Decomposing organic matter, *Organic matter, *River beds, Running waters, Lotic environment, Benthic fauna, Sweden, Detritus, Degradation(Stream), Aquatic habitats, Mosses, Aquatic environment, Metabolism, Respiration, Microorganisms.

Assuming maximum respiration rate of five g O2/sq/m/d for all heterotrophes and a mineralization rate of 7.5 g organic matter sq m/d, maximum detrital processing capacity is 15 g/d for an average 100 m section of rapids along a relatively large stream. With a six cu m/sec discharge and one mg/l seston load, 500 kg/d is transported through this section, showing the function of running waters as transport channels for their drainage basins. Therefore, the major effects of suspended organic matter will not be found in streams, but outside their ecosystems. River Ricklean is an ungraded, fifth-order stream in northern Sweden with maximum discharge of 160-180 cu m/sec and minimum discharge of 3-10 cu m/sec. It is a fairly typical forest river, 48 km long with rapids constituting 16% of its length. The river bed stones' organic layer harbours an abundance of protozoans and micrometazoans. The 1975-1977 study revealed a considerable amount of organic matter on the stones, up to 354.8 mg/cu dm stone volume. A tentative estimate of the total benthic community respiration was compiled with a maximum Fontinalis community respiration of 3.6 g O2/sq m/d. The community respiration of the hyporheic habitat was estimated by measuring the top four cm, an underestimation. The total respiration was regarded as a tentative estimate of the maximum decomposition rate of the rapids. (Danovich-Wisconsin)
W80-01704

AQUATIC MOSSES AND STREAM METABOLISM IN A NORTH SWEDISH RIVER,
Umea Univ. (Sweden). Dept. of Ecological Zoology.
T. Johnson.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 1471-1477. 9 Fig, 7 Ref.

Descriptors: *Rivers, *Mosses, *Metabolism, *Respiration, Sweden, Benthic fauna, Running waters, Lotic environment, Aquatic habitats, River beds, Aquatic environment, Growth rates, Standing crops, Oxygen demand.

The role of the Fontinalis moss community is related to the general pattern of metabolism and function of detritus in the rapids of the River Ricklean, Sweden a meso-humic woodland river. The community consumes a maximum of 0.26 g oxygen sq m/h compared with maximum values for the stone community, 0.05 g O2/sq m/h, and the uppermost part of the hyporheic community, 0.03 g/O2/sq m/h. Standing crop was calculated from 20 random samples, and one sq m samples were taken from a 50 m long section rapid during August low water. Among the macrophytes, mosses dominated strongly. Of the four species of moss vegetation, Fontinalis dalecarlica covered 80% of the bottom area with 430 g Dw/sq m. Amounts of up to 770 g/sq m were obtained and on stable bottom areas of boulders of sand. Oxygen consumption and shoot growth were used as metabolism parameters. According to shoot growth, the vegetation period starts in ince-free parts of rapids with temperatures of the 0C range with highest growth rate slightly before the highest temperature. Respiration measurements show a relatively high activity at low temperatures, 0.15 g O2/sq mgh. The structure of the moss organic surface layer ranges from diatoms and bacteria on young shoots to fungal hyphae, interwoven with particles into a thick web, completely covering older parts. (Danovich-Wisconsin)
W80-01705

DYNAMICS OF THE PHYTOPLANKTON IN THE RIVER LOT,
Toulouse-3 Univ. (France). Lab. d'Hydrobiologie.
J. Capblanco, and H. Decamps.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1479-1484. 3 Fig, 1 Tab, 12 Ref.

Descriptors: *Rivers, *Phytoplankton, *Photosynthesis, *Chlorophyta, Low flow, Lotic environment, Respiration, Biomass, Growth rates, Chlorophyll, Chemical analysis, Aquatic algae, Marking techniques, Tracking techniques, Currents(Water), On-site data collections.

The relationship between the photosynthetic activity of algae, measured by the Cl4 method or by oxygen, and the increase in biomass in the Lot River, France, is variable and can be determined only by simultaneously measuring algal respiration. Photosynthesis rate ranged 136-919 mg C/cu m/d and increase in biomass ranged 51-188 mg C/cu m/d. Comparing daily rates of photosynthetic assimilation and increase in biomass indicates that organic matter rapidly degrades. Only 20-25% of assimilated carbon returns to new biomass. This paper monitors a moving mass of marked water over a distance of 52 km, on the river during low flow to examine the dynamics of the inhabiting phytoplankton. The experiment took place on August 20-25, 1975, with regularized water flow of 16-19

cum m/sec. The water was marked with rhodamine. Chemical, biological, and physical parameters were measured and analyzed. Chlorophycae represented 70-90% of the algae volume, with Coelastrum reticulatum being the dominate species and showing the highest growth rate, from 500 cells/ml to 50,000 cells/ml. The water was subject to continuous mixing and the abundance of mineral and organic matter in suspension reduced light penetration, increasing the relative time spent by algae in darkness and reducing net algae production. The carbon assimilated and degraded corresponds to nearly 50% of the rate of oxygen consumption although this value is still in question. (Danovich-Wisconsin)
W80-01706

FACTORS THAT DETERMINE THE BENTHIC SECONDARY PRODUCTION IN TWO LAKE OUTFLOWS--A CYBERNATIC MODEL,
Kiel Univ. (Germany, F.R.). Zoologisches Inst.
B. Statzner.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1517-1522. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Benthic fauna, *Secondary productivity, *Comparative productivity, *Model studies, *Upper Schierenseebrook(West Germany), *Lower Schierenseebrook(West Germany), Runoff, West Germany, Running waters, Invertebrates, Discharge(Water), Cycles, Aquatic productivity, Food chains, Ecosystems, Ecological distribution, Spatial distribution, Productivity, Biomass, Dominant organisms, Habitats, Environmental effects.

A cybernetic model study about the dependence of benthic secondary production on biological and environmental factors concludes that knowledge of energy pathways does not necessarily lead to an understanding of a system, in contrast, the coincidence of some very small biological details of the species involved to a large extent determines the character of the outflow communities. A 1974-1975 field study was carried out in two lake-fed brooks in northern Germany to investigate classification of running water ecosystems. The running waters, named the Upper and Lower Schierenseebrook, are situated between three eutrophic lakes near Kiel. Nearly 385,000 macroinvertebrates were collected in benthon, drift, corer, net captures, and artificial substrate samples. Greatest abundance of filter feeders was found just below the lakes and was mainly caused by Neureclipsis bimaculata (Trichoptera) and Dreissena polymorpha (Bivalvia). Since the annual benthic production of the Upper stream was 592 kcal sq m and the Lower stream was 1557 kcal sq m, a cybernetic model was developed based on the four most important species and environmental factors to explain the differences in the production of filter feeders. Many external factors such as lake and riparian vegetation affected the community, clearly demonstrating the ecotone characteristics of the outflow systems. (Danovich-Wisconsin)
W80-01708

EVALUATION OF THE MESH BAG METHOD FOR STUDYING LEAF COLONIZATION BY STREAM INVERTEBRATES,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
M. J. Winterbourn.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1557-1561. 3 Fig, 6 Ref.

Descriptors: *Testing procedures, *Materials testing, *Invertebrates, *Midges, *Diptera, On-site data collections, Data collections, Sampling, *Leaves, Running waters, New Zealand, Food chains, Habitats, Larvae, Water beetles, Mayflies, Caddisflies, Niches, Stoneflies, Biological communities, On-site tests, On-site investigations.

The major drawback of mesh bag methods for studying leaf colonization in a 1976 New Zealand small forest stream field experiment is that it is impossible to distinguish between animals associated with leaves and those on the bags themselves. Similar species numbers and the same species were taken from bags with and without leaves and comparable invertebrate densities were found in all bags when considered as numbers per total surface area available for colonization. The study: (1) measured weight and area leaf changes in bags of two mesh sizes which were exposed to the stream community; (2) examined size and composition of invertebrate fauna colonizing the bags; and (3) investigated colonization effects of the bags themselves. Green leaves of a single branch of red beech, Nothofagus fusca, were dried and used Three bags of each type (40 leaves, 80 leaves, plastic squares, empty, 0.2 mm mesh, one mm mesh) were placed in three 10 mm nylon sacks which were anchored to the stream bed and at 25, 73, and 112 day intervals one sack was removed Leaf weight loss was greater in coarse-mesh than fine-mesh bags. Twenty-five invertebrate species were found including an abundance of larval Chironomidae in all bags, and other important taxa such as two stoneflies, Zelandobius confusus and Spaniocerca zelandica, a caddisfly, Zelandopsyche ingens, and an helodid beetle larvae. Mean midge densities per total surface area were similar in all coarse mesh bags suggesting that leaves were not preferentially selected substrates for chironomid larvae. (Danovich-Wisconsin)
W80-01709

PHYTOPLANKTON ECOLOGY OF SHATT AL-ARAB RIVER AT BASRAH, IRAQ,
Bangladesh Agricultural Univ., Mymensingh. Faculty of Fisheries.
M. F. HuQ, H. A. Al-Saadi, and H. A. Hameed
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1552-1556. 2 Fig, 18 Ref.

Descriptors: *Diatoms, *Phytoplankton, *Biological communities, *Ecological distribution, *Algae, Iraq, Sewage, *Shatt al-Arab River, Rivers, Cyanophyta, Chlorophyta, Benthic flora, Ecology, Distribution patterns, Distribution, Aquatic algae, Plankton, Plant groupings, Marine algae

A total of 107 species, 74.7% of which were diatoms, were identified in a September 1976-May 1977 study of the Shatt al-Arab River at Basrah, Iraq. The river is formed by the Tigris and Euphrates rivers and flows 120 km into the Persian Gulf. Average discharge is 678 cu m sec and is 0.5 km wide at Basrah. It is also affected by diurnal tides with a 1.7 m average water level variation The 0.5 million population city empties its untreated sewage into the river. Three stations near the city were sampled monthly; chlorsity varies 0.16-0.29 g l, pH 7.66-8.02, and DO 4.7-9.7 ppm. Phytoplankton totals show bimodal distribution, reaching maximum in November and March and minimum in December and May. The November peak is probably due to receding flood water and the March pulse is due to stable water levels. Besides the predominate pennate diatoms, green algae constitute 10.28% and blue-green algae 14.01% of total species. The most commonly occurring species are Bacillaria paradoxa, Cocconeis placentula, Diatoma vulgare, Rhoicosphenia curvata, and Synedra ulna. The population is dominated by benthic species (82.5%), and plankton constitute 15%, epiphytic species 2.5%. Freshwater species dominate (63%) compared to 21% brackish and 16% marine habitats. (Danovich-Wisconsin)
W80-01712

AN APPROACH TO MODELLING PRODUCTIVITY IN RESERVOIRS,
McGill Univ., Montreal (Quebec). Dept. of Biology.
M. L. Ostrofsky, and H. C. Duthie.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1562-1567. 1 Fig, 37 Ref.

Descriptors: *Phosphorus, *Nutrient budgets, *Mathematical studies, *Reservoirs, *Reservoir stages, *Smallwood Reservoir(Canada), Productivity, Cycles, Trophic levels, Nutrients, Equations, Curves, Nutrient loading, Leaching, Impoundments, Impounded waters, Lakes, Ecosystems, Phytoplankton, Model studies, Canada.

Leaching forest litter is the key nutrient source in the Smallwood Reservoir in Labrador, Canada. New reservoirs pass through a stage of high biological activity, trophic upsurge, and then give way to a much reduced activity stage, trophic depression, trophic upsurge, and then give way to a much reduced activity stage, trophic depression; this 1974-1975 study tested a phosphorus dynamics hypothesis for predicting magnitude and duration of reservoir stages. Weekly sampling during the ice-free season was carried out on the reservoir and an adjacent natural lake, Mile 83 lake. Primary productivity rates were higher in the reservoir in both years, 1974-1975, averaging 107-168 mg C sq m d, respectively, than in Mile 83 lake, 59-96 mg C sq m d, respectively. P budgets were constructed with the atmosphere contributing 0.44 kg P ha yr and the land surface exporting 3.72 mg P sq m yr. Predicted and observed P concentrations in the lake agreed but in Smallwood Reservoir the predicted P concentration (6.1 mg cu m) was less than 50% of the observed value (12.6 mg/cu m). The most obvious important P source overlooked was the inundated vegetation and soils. Mathematical studies on the mass balance equation and leaching input were performed and concluded that an average P contribution of 15 mg P/sq m resulted from leaching. P was graphed as a function of time and high P concentrations corresponded to trophic upsurge and decreasing P concentrations to that of trophic depression. (Danovich-Wisconsin)
W80-01713

ECOLOGICAL HETEROGENITY BETWEEN NORTH-TEMPERATE RESERVOIRS AND GLACIAL LAKE SYSTEMS DUE TO DIFFERING SUCCESSION RATES AND CULTURAL USES,
Ontario Ministry of Natural Resources, Thunder Bay.
R. A. Ryder.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1568-1574. 2 Fig, 1 Tab

Descriptors: *Lake stages, *Reservoir stages, *Ecology, *Biological communities, *Succession, Ecosystems, Reservoirs, Lakes, Glaciohydrology, Ecological distribution, Adaptation, Evolution, Lotic environment, Environmental effects, Geographical regions, Climatic regions, Temperate, Productivity, Lentic environment.

This literature survey emphasizes that winter drawdown is the principle cultural use inducing greatest abiotic stress on north-temperate reservoir communities. The survey also compares ecosystem attributes and emergent properties of glacial lakes and reservoirs, and proposes the selection of a top fish predator to smooth transformations in biotic reservoir regimens. Creation of a large winter drawdown zone imposes severe stresses on fish, invertebrate bottom fauna, and macrophytes. The whole impoundment aquatic system retrogresses to a juvenescent successional lake ecosystem stage in which pelagic autrotrophy dominates as the simple food web base. While reservoirs are young on an evolutionary basis, they pass through early successional stages more rapidly than counterpart glacial lakes due to rapid nutrient augmentation from newly inundated substrate. A reservoir is a distinct king of tenuous ecosystem retaining specific lotic and lentic environmental characteristics. Ecosystem changes created by dam construction produce radical alterations to indigenous river communities which degrade rapidly because they are oriented primarily toward substrate, water surface, or shoreline interfaces and are replaced by pelagiphils from lake communities. Genetic selection of organisms such as top fish predator having the ability to opportunistically adapt to rapid and inequitable nutrient flux and the use of pelagic sites for metabolic activity would tend to dampen biotic oscillations and lessen radical departure from steady state. (Danovich-Wisconsin)
W80-01714

PHOSPHORUS REMOVAL BY SEDIMENTATION IN SOME IOWA RESERVOIRS,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
J. R. Jones, and R. W. Bachmann.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1576-1580. 2 Fig, 2 Tab, 16 Ref.

Descriptors: *Reservoirs, *Phosphorus, *Nutrient removal, *Sedimentation rates, Iowa, Lakes, Mathematical models, Sedimentation, Nutrient budgets, Cycling nutrients, Sediments, Reservoir silting, Impoundments, Model studies, Equations, Seasonal.

Sedimentation coefficients two orders of magnitude greater than those used for natural lakes were necessary to calculate summer phosphorus levels in Iowa reservoirs. Morphometric and watershed data were summarized and inflowing streams were monitored every 10-15 days for two years to estimate the annual TP inputs for Big Creek, Don Williams, Hickory Grove, and McFarland reservoirs. Various phosphorus models were used to predict reservoir concentrations but all models overestimated summer phosphorus values by three to ten times. A sedimentation coefficient of 37, as compared to 0.65 for natural lakes, was used in the Vollenweider equation, causing agreement between the observed and predicted phosphorus concentrations. Phosphorus levels in natural lakes did not change from spring to summer, but late summer values averaging 37% of spring phosphorus concentrations were found in reservoirs due to high phosphorus sedimentation rates. Because of high phosphorus sedimentation rates, phosphorus concentrations in reservoirs were less than would be expected from phosphorus loading models developed from natural lake data. (Danovich-Wisconsin)
W80-01715

PRIMARY PRODUCTIVITY AND PHYTOPLANKTON BIOMASS IN THE BIG EAU PLEINE RESERVOIR, WISCONSIN,
Wisconsin Dept. of Natural Resources, Rhinelander.
J. F. Sullivan.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1581-1586. 3 Fig, 2 Tab, 19 Ref.

Descriptors: *Primary productivity, *Reservoirs, *Biomass, *Phytoplankton, *Big Eau Pleine Reservoir(WI), Wisconsin, Wisconsin River, Chlorophyll, Light, Nutrients, Runoff, Phosphorus, Algae, Cyanophyta, Diatoms, Dominant organisms, Eutrophication, Productivity.

Phosphorus input and increased solar energy in summer 1976 provide optimal conditions for greater phytoplankton growth on the eutrophic Big Eau Pleine Reservoir, Marathon County, Wisconsin. The reservoir, located on the Wisconsin River, experiences annual water fluctuations up to nine m, dense blooms of Aphanizomenon flos-aquae during summer and fish kills due to low DO concentrations in winter. Agriculture, alone with municipal and industrial inputs, accounts for most nutrients. Average primary production rates for 1975 and 1976 were 1.29 and 3.00 g C sq m d. Average daily insolation was 31% higher during a summer 1976 than summer of 1975. Reactive phosphorus concentrations was high in spring as a result of runoff and accounted for 70-80% of the TP loading. TN and TP loading was higher in spring 1976, 23.0 and 2.27 kg ha, than 1975, 15.9 and 2.06 kg ha. A significant reduction (13%) in reservoir area in summer 1976 compared to 1975 may have artificially concentrated the blue-green algae. However, it was unlikely that reservoir drawdown was as important as increased primary productivity in increasing the phytoplankton biomass. Primary production increased 130% on an areal basis and was correlated with an 100% increase in phytoplankton biomass during the open-water period of 1976 as compared to 1975. (Danovich-Wisconsin)
W80-01716

LEAF BREAKDOWN AND INVERTEBRATE COLONIZATION ON A RESERVOIR BOTTOM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. R. Webster, and G. M. Simmons, Jr.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1587-1596. 2 Fig, 3 Tab, 42 Ref.

Descriptors: *Leaves, *Reservoirs, *Biodegradation, *Decomposing organic matter, *Claytor Lake(VA), Invertebrates, Lakes, Streams, Degradation(Decomposition), Habitats, On-site tests, On-site investigations, Sampling, Benthic fauna, Food habits.

Detrital consumers capable of direct or indirect utilization of leaf material contribute to leaf breakdown in Claytor Lake, western Virginia. This 1975-76 study examines breakdown rates of nine tree leaf species and one aquatic macrophyte on a reservoir bottom and macroinvertebrate colonization on four leaf species. Claytor Lake is a 1922 ha impoundment on New River and has a maximum depth of 36.5 m. In December, 1975 leaf bags in 10 groups were placed at four and seven m depths and were retrieved in January, March, May, July, and September 1976. For all species there is no significant difference between breakdown rates at these depths. Based on breakdown rates, leaves are classified into three groups: dogwood and cattail break down rapidly (0.01044-0.01038/d); sourwood, poplar, hickory and maple are in a medium group (0.00896-0.00817/d); and rhododendron, oak, chestnut, and sycamore break down slowly (0.00625-0.00325/d). Lake breakdown is faster than terrestrial breakdown but generally slower than stream breakdown for dogwood, hickory, poplar, maple, and sycamore leaves. Sourwood, chestnut, white oak, and rhododendron leaf breakdown in forests is slower than breakdown rates in Claytor Lake. However, rhododendron and white oak leaf breakdown rates are faster than stream breakdown rates. All leaf species exhibit an increase in the number of organisms/g Dw leaf material. A total of 18 taxa including Hyalella azteca, Asellus sp, Chironomidae, Planaria, and Oligochaeta are identified. (Danovich-Wisconsin)
W80-01717

LIGHT AND ZOOPLANKTON AS ALGAE REGULATING FACTORS IN EUTROPHIC BIESBOSCH RESERVOIRS,
Waterwinning-Bedrijf Brabante Biesbosch (Netherlands).
G. Oskam.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1612-1618. 4 Fig, 3 Tab, 6 Ref.

Descriptors: *Zooplankton, *Growth rates, *Reservoirs, *Light, *Limiting factors, *Biesbosch Reservoirs(Netherlands), Algae, Eutrophication, Pumped storage, Water supply, Mathematical models, Algal control, Phytoplankton, Netherlands, Biomass, Productivity, Nutrients.

According to a light-limited algal growth kinetic model for the two Biesbosch reservoirs in the southwestern Netherlands, a maximum algal biomass of 30-40 mg cu m chlorophyll was predicted, compared to observed maximum algal concentrations ranging 20-60 mg cu m chlorophyll in 1974-1977. Observed values on one reservoir were within the predicted range for the four years, whereas observed values exceeded the predicted range for the other reservoir in 1976 and 1977. The Biesbosch pumped-storage reservoirs, formed by the River Meuse, are used for public water supplies. Average total P and total N concentrations in the Meuse River water are higher than 0.5 mg/l and 5 mg/l, respectively. A model was developed to evaluate a light-limiting algal growth method and give predictions of maximum algal concentrations. Basic assumptions are that vertical algal distribution stays homogeneous because of an air injection system at the reservoir bottom, and that nutrients are not limiting factors. A mixing depth of 15 m, which was planned for the reservoirs to maintain the stored waters' chemical quality, could effectively restrict algal development to an acceptable level if the extinction coefficient were 1.0/m or more. Grazing by zooplankton populations, consisting predominantly of Cladocera (Daphnia and Bosmina) and to a lesser extent Copepods (Cyclops), also keeps algal biomass at much lower levels than light limitation would permit. (Danovich-Wisconsin)
W80-01720

STUDY OF THE PHOSPHORUS LOADING AND RETENTION IN IJSSELMEER,
Hydrobiologisch Inst., Nieuwersluis (Netherlands).
W. A. De Kloet.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1619-1623. 3 Fig, 1 Tab, 9 Ref.

Descriptors: *Phosphorus, *Phosphates, *Biological degradation, *Articicial lakes, *Nutrient removal, *Ketelmeer Lake(Netherlands), Eutrophication, Netherlands, Rivers, Sedimentation, Nutrient loading, Cycling nutrients, Phosphorus compounds, Water properties, Water quality, Lakes, Correlation analysis, Regression analysis.

A decrease in TP concentrations in Ketelmeer Lake which forms a transition between the Ijssel River and Ijsselmeer Lake, largest freshwater lake in the Netherlands, is due to phosphage and particulate P decreases. Decreased phosphate concentrations are caused by biological fixation, physicochemical fixation, and dilution with Ijsselmeer water. Half the phosphate concentration decrease is due to biological removal in Ketelmeer. Sedimentation to the Ketelmeer lake bottom plays a major role of particulate P decrease. The rate of eutrophication of Ijsselmeer has sharply increased since 1950 with a TP input of 7.7 million kg in 1969, 60% of this coming from Ijssel River. The present study investigates the role of Ketelmeer as a P sink and collected water samples from Ijssel River, Ketelmeer, and Ijsselmeer on four consecutive days each month from June 1971-March 1972. The average decrease in TP from Ijssel to Ketelmeer was 36.7% in summer and 28.9% in winter and was significantly correlated with distance. The average phosphate concentration was 41.6% lower in Ketelmeer than Ijssel in the summer and 18.4% in the winter. Average particulate P concentration in Ketelmeer was 30.4% lower in summer and 38.4% in winter than in Ijssel. (Danovich-Wisconsin)
W80-01721

BENTHOS TYPOLOGY OF SPANISH RESERVOIRS,
Barcelona Univ., (Spain). Dept. of Ecologia.
N. Prat.
In: Proceedings Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1647-1651. 1 Fig, 1 Tab, 9 Ref.

Descriptors: *Reservoirs, *Benthic fauna, *Classification, *Trophic level, *Spain, Diptera, Biomass, Oligochaetes, Tubificids, Ecosystems, Productivity, Standing crops, Eutrophication, Mesotrophy, Oligotrophy, Impoundments.

This July 1973-January 1975 study of 79 Spanish reservoirs classifies them according to benthonic organisms with a special emphasis on Chironomidae. Brundin's Lake classification sytem based on Chironomidae indicator species is used, although some Spanish biogeographic pecularities are evident. The typical European and American species characteristic of mesotrophic reservoirs, Stictochironomus rosenscholdi, is substituted by S. maculipennis in Spanish reservoirs. Dominant reservoir forms are Tubificidae (Oligocheate) representing 90% of total numbers and Chironomidae (Diptera) representing 9%. Only three Chironomidae genera are present in over 10% of reservoirs; Procladius (62%), Chironomus (48%), and Stictochironomus (29%), Spain has no ultraoligo-trophic reservoirs. Only one reservoir in an area of scarce human settlements and high altitude is classified with Brudin's group II, moderately oligotrophic

lakes with Tanytarsus as indicator species. Light sediment, no severe anoxia, relatively deep, and Chironomidae absence characterize mesotrophic reservoirs. This classification is modified to include some Chironomidae, namely Procladius and Stictochironomus, but not Chironomus. Eutrophic reservoirs include Chironomus and Stictochironomus and generally are shallow with high average biomass (5.6-9.7 mg chl a cu m). Chironomus colonization is prevented in ultraeutrophic reservoirs by extreme oxygen depletion and depth. (Danovich-Wisconsin)
W80-01723

FACTORS GOVERNING TURBIDITY IN A SOUTH AFRICAN RESERVOIR,
R. D. Walmsley.
In: Proceedings: Congress in Denmark 1977. Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1684-1689, 3 Fig, 7 Ref.

Descriptors: *Turnovers, *Reservoirs, *Water circulation, *Transparency, *Turbidity, *Thermal stratification, *Lindleyspoor Dam(South Africa), South Af+rica, Stratification, Secchi discs, Destratification, Mixing, Physical properties, Movement, Water properties, Runoff, Rainfall, Suspension, Silts, Chlorophyll, Light, Primary productivity.

Several mechanisms affect euphotic zone depth in Lindleyspoor Dam, South Africa: Sedimentation and turbid reservoir water dilution by less-turbid inflow waters increases photic zone depth; highly turbid water influx decreases photic zone depth; circulation processes increase and maintain photic zone depth. This weekly study May 1975 to May 1977 examined seasonal turbidity characteristics in a subtropical reservoir. Lindleyspoor Dam, with a 15.8 billion cu m volume, 175 ha area, and 22 m maximum depth, has a warm, monomictic thermal cycle (10.2-27.7C); southern hemispheric winter circulation occurs between May and August, while summer stratification occurs between August and April. During winter circulation periods, surface and bottom turbidity are equal. At this turbidity level, 50 JTU, secchi disc transparency is 0.2 m. After August temperature stratification, marked turbidity stratification is observed. In November, surface water turbidity decreases to 18 JTU, 0.8 m secchi disc transparency. In mid-December with the first spring rains, a flood increases bottom turbidity (60-310 JTU), but has little effect on surface water turbidity. A mid-January flood results in surface water turbidity increases (28-220 JTU) and 0.05 m secchi disc transparency. Turnover in May results in suspended material recirculation from bottom to the surface and establishes uniform turbidity profiles. No relationship exists between secchi disc transparency and chlorophyll, whereas a hyperbolic relationship exists between secchi disc transparency and turbidity. (Danovich-Wisconsin)
W80-01724

MAN-MADE STRESS PATTERNS IN TWO IMPOUNDMENTS,
Orange Free State Univ., Bloemfontain (South Africa). Inst. of Environmental Science.
D. F. Toerien, and R. D. Walmsley.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1690-1694. 1 Fig, 3 Tab, 8 Ref.

Descriptors: *Dams, *Water pollution sources, *Water quality, *Effluents, *Reservoirs, Impoundments, South Africa, Dewage, Sewage effluents, Agricultural runoff, Recreation, recreation wastes, Watersheds(Basins), Land use, Industrial wastes, Wastes, Land development, Eutrophication, Phytoplankton, Growth rates, Transparency, Roodeplant Dam(South Africa), Buffelspoort Dam(South Africa).

Monthly limnological data were collected March 1973 to April 1975 from two South African impoundments, Roodeplaat and Buffelspoort Dams, to evaluate water quality stress patterns induced by effluent disposal. Buffelspoort Dam water quality is fairly homogenous but increased catchment development might quickly result in detrimental changes. Roodeplaat Dam water quality is heterogenous with lowest water quality and highest phytoplankton growth closest to Pienaars River inflow and highest water quality and least phytoplankton growth near Edenvale Spruit inflow. Roodeplaat Dam with 42.1 million cu m volume and 10.6 m average depth, has a sinuous shape. Sewage effluents reach the dam by way of Pienaars, industrial effluents by way of Hartbees Spruit, while Edenvale Spruit drains agricultural lands, Significant parameter differences are observed in Roodeplaat Dam, indicating a severely stressed system Pienaars River contributes minerals, large dissolved N and P quantities, and some dissolved organic substances. Recreational activities which are impeded by phytoplankton blooms and low water transparency should be zoned in areas other than Pienaars River. Hartvbees Spruit contributes minerals, probably from industrial effluents. Edenvale Spruit is an important organic pollution source. Buffelspoort Dam is smaller with 12.9 million cu m volume and 7.9 m average depth, and drains agricultural lands and a few holiday resorts. Parameters are higher, although not significantly so, closest to the main inflow. (Danovich-Wisconsin)
W80-01725

EFFECTS OF IMPOUNDMENTS ON RIVERS: AN AUSTRALIAN CASE STUDY,
Adelaide Univ., (Australia). Dept. of Zoology.
K. F. Walker, T. J. Hillman, and W. D. Williams.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Aggewandte Limnologie, Vol 20, 1978. p 1695-1701. 3 Fig, 1 Tab, 3 Ref.

Descriptors: *Impoundments, *Rivers, *Environmental effects, *Murray River(Australia), Australia, Reservoirs, Flow, temperature, Oxygen, Water properties, Water quality, Biological communities, Seasonal, Thermal stratification, Land development, fish, Physical properties, Adaptation, Oxygen sag, Succession, Competition, Invasion.

Environmental changes caused by water shortages were examined December 1973 to December 1976 in the Murray River, Australia. The river's water level is influenced by Lake Hume, a large reservoir built from 1936 to 1961. This paper comments on Lake Hume's effects on flow, temperature, oxygen regimes, and local fish fauna. Lake Hume has a 202.5 sq area, 3.07 million Ml volume and 15.2 m average depth. The impounded water is backed up along two river valleys, the Murray and Mitta Mitta. Releases from Lake Hume are governed by irrigation requirements in downstream areas. Regulation maintains higher than natural flows over the summer dry period. Seasonal temperature cycles occur in the Murray and Mitta Mitta rivers with mid-winter minimum, 6-7 C, and late summer maximum, 23-24C. Lake Hume affects seasonal thermal stratification; heat is stored in the lake. Temperature gradient is most pronounced near the dam and differential between top and bottom waters is maximum stratification at 3-8 C. A common thermal stratification side effect is for complete hypolimnetic oxygen depletion to occur causing an oxyagen sag to almost 100 km downstream. Two native species that have disappeared due to Lake Hume environmental changes are golden perch, Pectroplites ambiguus, and freshwater catfish, Tandanus tandanus. Several interoducted fish species, notably golden carp (Carassius auratus), redfin (Perca fluviatillis), tench (Tinca tinca), and trout (Salmo) are becoming increasingly dominant. (Danovich-Wisconsin)
W80-01726

STABILITY OF DIURNAL STRATIFICATION IN THE FORMING BROKOPONDO RESERVOIR IN SURINAME, SOUTH AMERICA,
Vrije Univ., Amsterdam (Netherlands). Biological Lab.
J. Van der Heide.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereiningung fur Theoretische und Angwandte Limnologie, Vol 20, 1978, p 1702-1709. 4 Fig, 12 Ref.

Descriptors: *Reservoirs, *South America, *Thermal stratification, *Tropic, *Water temperature, *Diurnal, *Lake Brokopondo(South America), Geographical regions, Stratification, Thermocline, Temperature, Environmental gradient, Hypolimnion, Oxygen, Heated water, Climatiz zones, Dry seasons, Lakes, Conductivity, Distribution, Depth, Stratification.

A diurnal cycle of temperature, oxygen content, and conductivity with depth was followed on May 15-16, 1964 at station Afobaka in Lake Brokopomdo, S. America, providing evidence that even slight tropical temperature gradients disclose definite stratification patterns if they are studied frequently and for long enough. Lake Brokopondo was formed by inundating a 1500 sq km tropical rain forest. Conditions near the dam have stabilized with differentiation appearing between oxygen containing epi/metalimnion and anoxic hypolimnion. Observations were made in the dry periods. Temperatures fluctuate (17-30C) in the top few meters, below which it remains almost constant and gradually decreases with depth. Oxygen curves follow temperature curves at corresponding depths very closely. The whole water mass below three meters is anoxic; and almost complete water deoxygenation occurs at dawn accompanied by an inverse temperature stratification in top layers. Surface oxygen levels rise to five mg/1 after sunset as a result of horizontal transports from less disturbed areas. Conductivity gradients confirm stratification stability in deeper layers. In spite of small temperature differences, corresponding density gradients are steep. Homothermal conditions are seldom observed, indicating that stratification is dynamic and interchange between layers occurs by turbulences and internal waves. In stratification terms, Lake Brokopondo is a small lake type. (Danovich-Wisconsin)
W80-01727

TEMPERATURE AND OXYGEN STRATIFICATION IN AMERICANA RESERVOIR, STATE OF SAO PAULO, BRAZIL,
Sao Paulo Univ. (Brazil). Dept. of Ecology.
C. G. Froehlich, M. S. Arcifa-Zago, and M. A. J. de Carvalho.
In: Proceedings: Congress in Denmark, 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1710-1719. 11 Fig, 2 Tab, 28 Ref.

Descriptors: *Water circulation, *Water temperature, *Thermal stratification, *Stratification, *Americana reservoir(Brazil), Temperature, Brazil, South America, Thermocline, Movement, Oxygen, Dissolved oxygen, Diurnal, Reservoirs, Seasonal, Lakes, Depth.

Temperature and dissolved oxygen measurements take from Americana Reservoir, Brazil, 1974-1976, show that this water body circulates fully at irregular intervals during the year ad therefore is polymictic. Thermal behavior is complex and has no definite seasonal pattern. STratification, while evident during sampling, seems unstable and short in duration. Differences in temperatures curves occur in samples taken a few hours apart. Thermoclines were seldom registered; however, temperature gradients are sufficient to maintain stratification, as evidenced by low DO bottom values. Dissolved oxygen curves generally follow temperature curves, but often with a steeper decrease. Superficial values vary 143.1% to 38.3% saturation; bottom values 47.3% to 0.0% saturation. Diurnal surface warming on calm sunny days attains 3-7 m depth, independent of season; one surface temperature value reached 33C. During April to September cool months, Sao Paulo is subjected to Atlantic Polar Front cold air mass intrusions. Marked temperature drops greatly influence reservoir circulation and holomixis may occur. During October to March warm rainy seasons, stratification may be lost due to heavy rains cooling surface waters and increasing river discharge, with large flood volume consequent effects. Wind influence is not great in promoting total circulation since strong winds are absent in this region. (Danovich-Wisconsin)
W80-01728

VERTICAL MIGRATION OF DAPHNIA GESSNERI HERBST, 1967, IN AMERICANA RESERVOIR, STATE OF SAO PAULO, BRAZIL,
Sao Paulo Univ. (Brazil). Dept. of Ecology.
M. S. Arcifa-Zago.
In Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereiningung fur Theoretische und Aggewandte Limnologie, Vol 20, 1978, p 1720-1726 6 Fig, 17 Ref.

Descriptors: *Migration, *Animal behavior, *Daphnia, *Americana Reservoir(Brazil), Zooplankton, Reservoirs, Brazil, Migration patterns, Diel migration, Thermocline, Plankton, Crustaceans.

Four 48 hr vertical and horizontal samples were taken April, July, September, and December 1974 from Americana Resevoir, Brazil, to investigate occurrence of migration of Daphnia gessneri, a planktonic Cladoceran Species, and to find common environmental factors. Data should be viewed critically because of sampling errors. Vertical samples alone show that animals do not migrate; but horizontal samples demonstrate that zooplankton prefer superficial layers at night. Certain animal movements are fround in the water column, although not the entire population. Males and both young and adult females prefer the 0-6 m layer during day and night; young females are found in greater numbers 0-3 m. Behavior during one 24 hr period was not identical to the next 24 hr period. No seasonal pattern exists. Thermoclind (6-9 m in September) is a significant barrier to D. gessneri displacement. No clear relationship, exists between transparency and the depth where animals are distributed. Generally, D. gessneri behaves like many planktonic Cladocera in temperate lakes. (Danovich-Wisconsin)
W80-01729

DISSOLVED OXYGEN AND WATER TEMPERATURE STUDIES IN POOL NO. 2 OF THE UPPER MISSISSIPPI RIVER,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
H. Stefan, and W. S. Combs, Jr.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1744-1751. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Mississippi River, *Dissolved oxygen, *Water temperature, *Low flow, *Water circulation, Water levels, Minnesota, Temperature, Rivers, Mixing, Winds, Sewage, Flow, Photosynthesis, Effluents, Water quality, Sewage effluents, Bodies of water, Aeration, Oxygenation, Upper Mississippi River.

A 1976 study of upper Mississippi River water quality, including sewage effluents at St. Paul, Minnesota, under low flow conditions, demonstrated the significance of wind mixing and photosynthesis in recovering dissolved oxygen levels. In the summer of 1976, a severe drought occurred and upper Mississippi flow rates fell from normal 300 cu m s to 30 cu ms. This waste load allocation study extended 23 km from the waste treatment plant at St. Paul to Lock and Dam No. 2 at Hastings, Minnesota. An oxygen sag curve formed 3-14 km downstream from the sewage treatment plant outfall. Far upstream locations coincided with preceding hot sunny weather and southerly wind; far downstream conditions with preceding easterly wind and cloudy skies, two natural sources replenish dissolved oxygen; surface water re-aeration and photosynthesis. On a calm day with mean wind velocity 5.6 mph, 8/10 sky cover and one m mixing layer depth, net photosynthetic oxygen input is 7.3 g 02/sq m/d. Gravity, wind shear and buoyancy cause water motion and exchange. A drastic dissolved oxygen recovery from three to 13 mg 1 DO occurs in September at stations four miles apart due to buoyancy mechanisms in more shallow backwaters. These shallow backwaters and their long residence times produce strong dissolved oxygen and temperature variations. The system is complex due to highly unsteady vertical, lateral and longitudinal dissolved oxygen gradients. (Danovich-Wisconsin)
W80-01732

EFFECT OF A STREAM ELECTRIC GENERATING STATION ON THE EMERGENCY TIMING OF THE MAYFLY, HEXAGENIA BILINEATA (SAY),
Oak Ridge National Lab., TN.
J. C. Mattice, and L. L. Dye.
In Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereiningung fur Theoretische und Angewandte Limnologie, vol 20, 1978, p 1751-1758. 4 Fig, 1 Tab, 15 Ref.

Descriptors: *Environmental effects, *Heated water, *Mayflie, *Growth rates, *Electric powerplants, *Mature growth stage, *Kingston Steam Plant, Kingston, TN, Timing, Mathematical studies, Insects, Aquatic insects, Growth stages, Thermal pollution, Seasonal, Distribution, Water temperature, Waste water(Pollution), Tennessee, Effluents.

A June 1975-September 1976 study of emerging Hexagenia bilineata, a burrowing mayfly near Kingston Stem Plant, a nine-unit 1600 MW electric generating station, Tennessee, reveals that changes in emergence timing correlate well with water temperature. The mean day on which 50% of the mayflies had emerged was 29.6 days near heated water discharge outflow compared with 53.3 days at intake and 44.4 days at reference sites. June 1 is taken as day 1. The intake to discharge water temperature differential is 7.5 to 8.0C. Water temperature in the three areas follow typical seasonal temperate changes. Time order to median emergence is discharge, reference, and intake, following the same order as for mean temperatures. Emergence is intermittent June through August and generally occurs simultaneously in the three areas. Accelerated emergence near heated water plant discharges is not significant for whole reservoir mayfly populations. The combined study area equals less than 0.01% of the reservoir area. Environmental effects from Kingston plant operations on emergence patterns is thus localized. (Danovich-Wisconsin)
W80-01733

THE QUALITY OF GROUNDWATER IN CALIFORNIA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 5B.
W80-01734

ENERGY BALANCE OF RUNNING WATER SYSTEM,
Eidgenoessiche Technische Hochschule, Zurich (Switzerland).
W. Edelmann, and K. Wuhrmann.
In: Proceedings: Congress in Demark, 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1800-1805. 2 Fig, 4 Tab, 4 Ref.

Descriptors: *Algae, *Photosynthesis, *Energy budget, *Primary productivity, *Phototropism, Light, Light intensity, Biomass, Standing crops, Oxygen, Running waters, Growth rates, Plant growth, Energy, Energy equation, Mathematical studies, Productivity, Biological communities.

Experiments with three artificial outdoor channels confirm the Wuhrmann hypothesis that the ratio of radiant to chemical energy input into running water ecosystems correlates with phototrophic to heterotrophic biomass production rate proportion; phototrophic river biocenoses photosynthetic efficiency is also quantitatively measured. Growth rates, oxygen balances, and sociological conditions were observed 28 days in the channels; three and 1.5 mg sucrose 1 were added to channels 1 and 2, respectively, as an additional energy source. Mixed phototrophic/heterotrophic communities developed in channels 1 and 2 only phototrophs in channel 3. Phototrophic species composition is identical: dominant Tribonema minus, filamentous algae, and diatoms covering bottom surface. In channel 3, Achnantes and other diatoms grew over filamentous green algae. In channel 1 and 2, Sphaerotilus natans formed a considerable biocenosis part. A general rule could not be established for drift and standing crop increase ratio. Hetertrophic production is measured by phototrophic net production calculations from 02 data deducted from standing crop and drift increase. A second independent value is obtained from substrate sucrose consumption. Phototrophic energy balance was based on the photosynthesis equation; photosynthesis was inhibited by high light densities and quantum yields were elevated up to 0.12 02/quantum at low intensities. 85% of the energy fixed in biomass was leaving the system as microscopic drift. (Danovich-Wisconsin)
W80-01738

EFFECT OF HERBIVOROUS INSECTS ON THE PRODUCTION OF BENTHIC ALGAL VEGETATION IN OUTDOOR CHANNELS,
Eidgenoessische Anstalt fuer Wasservorsorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
E. Eichenberger, and A. Schlatter.
In: Proceedings: Congress in Denmark, 1977, Part 3; Internationale Vereinigung Fur Theoretische und Angewandte Limnologie, Vol 2l, 1978, p 1806-1810. 4 Fig, 1 Tab, 4 Ref.

Descriptors: *Algae, *Benthic flora, *Primay productivity, *Aquatic insects, Cyanophyta, Biological communities, Productivity, Biomass, Aquatic drift, Light, Light intensity, Photosynthesis, Herbivorous, Standing crops, Dominant organisms, Population, Ecology, Food chain, Predation.

A June-September 1976 study on herbivorous insect larvae effects on phototrophic benthos production patterns revealed changes in benthic species composition, loss in standing crops, and overgrazing problems. Initial vegetation development without aquatic insects produces filamentous algae and some diatoms followed by blue-greens such as Phormidium and Oscillatoria. Colonization production increases during the first month, stabilizes at five g odw/sq m/d and then drops to lower levels. As long as filamentous algae dominates, 30-60% of biomass is exported; once blue-greens are established, 5-10% is exported. In channels simultaneously exposed to insects and algae, no effect on standing crop accumulation is initially evident; however, grazing damage is apparent after seven weeks. Insects prevent blue-green community establishment. At grazing larval densities higher than 0.6 g odw/sq m/d, overgrazing is apparent; microphytic drift increases 5- to 7-fold, besides food egested, algal colonies appear in coarse drift fractions due to mechnaical vegetation damage. Production falls as standing crops are reduced to levels where nutrients and light are not optimally used. In colonies protected by herbivores for two months, blue-green vegetation grazing evolves with speed; average loss in standing crops is 4-5 g odw/sq m/d. Overgrazing might be a relatively frequent phenomenon masking productivity, especially where abruptly changing conditions upset ratios between herbivores and their predators. (Danovich-Wisconsin)
W80-01739

THE EFFECT OF DIMETHYL SULFATE ON THE REPRODUCTIVE SYSTEM OF THE LOACH, MISGURNUS FOSSILIS,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
For primary bibliographic entry see Field 5A.
W80-01743

SOME PROBLEMS IN FINDING GOOD STANDARDS FOR COOLING WATER,
KEMA N.V., Arnhem (Netherlands).
F. B. Koops.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978 p 1833-1836. 4 Ref.

Descriptors: *Water quality standards, *Cooling water, *Fish, *Plankton, *Environmental effects, *Heated water, Thermal stress, Entrainment, Mortality, Thermal powerplants, Water temperature, Regulation, Water policy, Water pollution, Stress, Mechanical equipment.

Studies on least possible ecological effects resulting from different quantities of discharged waste heat waters reveal that youngfish damage can be reduced by keeping temperature increases as high as possible and consequently cooling water quantities as low as possible; however, maximum permissible discharge temperatures (30 C) should not be exceeded. This literature survey concludes that decreasing cooling water quantities with resultant higher cooling water temperatures decreases total fish damage (thermal plus mechanical). Fish concentrate in warm outlet waters; however, increased temperature is not detremental. Damage does occur to larvae and juvenile fish entrained with cooling water and passing through the plant. Young fish entrainment is reduced when cooling water quantities decrease. With electric generation constant, this results in a proportional temperature increase. A maximum increase in discharge temperature to 34 C results in little phytoplankton damage and only minor damage to zooplankton with recovery in a few days. Detremental effects may increase on macro-invertebrates due to higher temperatures, however, diffusers near outlets would ensure rapid mixing. (Danovich-Wisconsin)
W80-01744

EFFECT OF HEXACHLORANE (HCCH) ON SOME HEMATOLOGICAL AND BIOCHEMICAL CHARACTERISTICS OF THE BLOOD OF THE ROUND GOBY (GOBIUS MELANOSTOMUS),
Odessa State Univ. (USSR).
For primary bibliographic entry see Field 5A.
W80-01745

MACROBENTHIC DIVERSITY AND ORGANIC POLLUTION IN THE ARCHIPELAGO OF ALAND (N BALTIC),
Abo Akademi Turku (Finalnd). Inst. of Biology.
For primary bibliographic entry see Field 5A.
W80-01748

NEW RESULTS ON PRIMARY PRODUCTION AND BIOGENIC AERATION IN GERMAN RIVERS,
Bundesanstalt fuer Gewasserkunde, Coblenz (Germany, F.R.).
D. Muller.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 1861-1866. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *West Germany, *Rivers, *Primary productivity, *Impoundments, *Energy budget, productivity, Seasonal, Oxygen, Phytoplankton, Light-dark bottle method, Dissolved oxygen, Photosynthetic oxygen, Photosynthesis, Water quality, Water pollution, Energy.

The order of increasing primary productivity of six West German rivers is Main (Steinheim Bend), Danube, Fulda, Rhine, Saar, and Moselle. Primary production measurements were performed on navigable German waterways to determine primary producer influences, such as secondary pollution effects and biogenic oxygen input, on constituent surface water budgets. Tewo methods were used: oxygen light/dark bottles and dissolved oxygen diurnal curves. In winter, production values hardly exceed measuring methods' error margins. In March, 4-5 g/sq m/d maximum values are reached. In summer, values higher than 20g/sq/m/d occur in some areas, but most values are below 14 g/sq m/s. In autumn, production decreases again to March values. In fair weather summer periods, 12 g/sq m/d for impounded rivers and nine g/sq m/d for free-flowing rivers are recommended for computing constituents budgets. With normal summer weather, values of five g/sq/ m/d or four g/sq m/ d, respectively, can be used. Moselle is an impounded, slow moving river; phytoplankton maximum density may already be reached before it enters German boundaries. Saar River is hydrogeographically and pollution-wise greatly diversified; most productivity values are below 10 g/sq m/d but considrerably higher extreme values occur in only slightly polluted areas. Main River values are relatively low; its waste water, by diminishing light and coprecipitating minerals, limits primary productivity. (Danovich-Wisconsin)
W80-01749

EFFECTS OF PRO-NOXFISH ON THE BENTHOS AND ZOOPLANKTON OF BUG LAKE, FOREST COUNTY, WISCONSIN,
Wisconsin Dept. of Natural Resources, Woodruff.
S. L. Serns.
Water Resources Bulletin, Vol 15, No 5, p 1385-1393, 1979. 1 Fig, 3 Tab, 22 Ref.

Descriptors: *Pesticide toxicity, *Zooplankton, *Benthic fauna, Rotenone, Diptera, Piscicides, Aquatic populations, Fish populations, Minnows, Sunfishes, Brook trout, Gastropods, Mortality, Daphnia, Copepods, *Pro-Noxfish, *Sulfoxide.

A concentration of 2.5 mg/1 Pro-Noxfish (0.063 mg/1 rotenone and 0.063 mg/1 sulfoxide) was applied to Bug Lake, Wisconsin, on November 17, 1975. There was an immediate toxicity to zooplankton and Chironomus. All taxa of benthic organisms and zooplankton that were present before toxicant application survived the treatment except for Pleuroxus denticulatus which was collected in only one sample before treatment. Comparable densities of benthic and zooplankton taxa were found on individual sampling dates before and after treatment; however, mean densities of trichopterans and dipterans were lower after treatment. The high variance in the sample along with the change in fish population after treatment are believed responsible for this indicated change in benthos density rather than the effects of the rotenone. (Deal-EIS)
W80-01750

CARBON BUDGET OF RIVERS AS EXEMPLIFIED BY THE DANUBE,
Bundesanstalt fuer Gewasserkunde Coblenz (Germany, F.R.).
T. Tittizer.
In: Proceedings: Congress in Denmark 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1873-1877. 5 Fig, 2 Ref.

Descriptors: *Carbon cycle, *Biochemistry, *Danube River(West Germany), *Self-purification, West Germany, Degradation(Decomposition), Carbon, Sewage, River, Flow, Water pollution, Carbonates, Carbon dioxide, Decomposing organic matter, Nutrient budgets, Waste assimilative capacity, Waste dilution, Water pollution effects, Organic compounds, Inorganic compounds.

Self-purification processes of the Danube River, West Germany, catabolize total organic carbon quantities equal to the sum of all organic carbon loads of the Danube's tributaries, the Altmuhl, Naab, Regen, Isar, Vils, Ilz, and Inn Rivers. Longitudinal profile examinations were carried out three years on the Danube River to determine waste water inflow effects on the processes. Various carbon forms, including TC, TIC, TOC, and DOC, and UOC were analyzed to determine degradability of various substances. The carbon budget is influenced by geology and anthropogenic substances. The Danube has a high inorganic carbon content, 45 mg/l, due to shell limestone and fossil coral reef formations in the drainage area. At 8.0-8.5 pH, inorganic carbon occurs mainly as hydrogen carbonate and carbonate ions. Carbon dioxide concentrations is negligibly low. Tributaries influence inorganic carbon level: the Isar River increases inorganic carbon whereas the Vils River has low lime content, decreasing inorganic carbon levels. Organic carbon results mainly from allochthonou-s pollution; downstream from heavy waste water inflows, organically-bound carbon concentration increases radically. Waste water from Regen and Naab tributaries increases total organic carbon content from 16 mg/l to 20 mg/l. Combining carbon and other water quality parameters (BOD), (COD), (TOD) provides valuable information for model computations, surface water recovery measures, and waste water load plains. (Danovich-Wisconsin)
W80-01751

ATTEMPTS TO REDUCE EUTROPHICATION IN AN ARTIFICIAL BATHING LAKE,
Technische Hochschule, Graz (Austria).
K. Stundl.
+n: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische Und Angewandte Limnologie, Vol 20, 1978. p 1878-1883, 5 Fig, 3 Ref.

Descriptors: *Eutrophication, *Sediments, *Artificial lakes, *Austria, *Nutrient removal, *Water pollution control, *Lake restoration, Nutrients, Phosphates, Water pollution, Detritus, Recreation, Beaches, Swimming, Sludge, Biomass, Phytoplankton, Zooplankton, Pollution abatement, Productivity, Water quality control.

Removing dead biomass from rich artificial lakes in Styria Province, Austria, provides the only means of controlling eutrophic tendendies of these bathing lakes. Lake Stubenberg, with a 45 ha area and eight m depth, is an example. After filling in 1971, eutrophication quickly set in and fish mortality rose. Peak bottom phosphate values in summer 1975 were 0.38 mg/1; ammonium was 7.0 mg/1. Sediments accumulated to 165 cu m/ha mazimum in 1975-1977. In order to prevent further eutrophication, the polluted feeder stream was diverted and river inflow was reduced, limiting nutrient inflow. Lake shallowness, however, promoted phytoplankton growth due to nutrient release from sediments. In 1975, the lake was emptied; sludge was cleared from bathing beaches and gravel was placed over the bottom. Sediment layers, which are continually deposited, are not drawn off with a suction sludge pump, reducing nutrient inflow. Bottom oxygen concentrations increased and in 1977, maximum transparency was 510 cm compared with 135-140 cm in previous summers. Primary production clearly decreased in 1976. Summer species consist of Cyanophyceae (Merismosedia teniussima, Microcystis flos-aque, and Aphanothece sp) and Chlorophyceae (Sphaerocystis). Crustacean density remains unchanged. Main rotifer species in 1976 are Kertella cochlearis, Polyarthra dolichoptera, and Conochilus unicornis. (Danovich-Wisconsin)
W80-01752

RELATION OF SAPROBIC TO TROPHIC LEVELS,
Prague Dept. of Water Technology and Environmental Engineering.
V. Sladecek.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1885-1889, 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Trophic level, *Biodegradation, *Microorganisms, *Saprobism, *Saprobity indes(S), *Degradation(Decomposition), Ecosystems, Productivity, Primary productivity, Plankton, Bacteria, Succession, Detritus, Decomposing organic matter, Biomass, Eutrophication, Phylogeny.

Saprobity and trophism are parallel limnological processes which sometines exhibit identical symptomatic characteristics and similar levels of intensity; however, the processes are factorially independent and must be studied separately in regard to their causes, effects and interrelationships. The index of saprobity (S) of communities of aquatic microorganisms represents the amount of putrescible organic matter and the intensity of its decompositon. Trophism is the extent and intenisty of organic primary production and its components can be quantitatively measured. Both phenomena occur together in surface waters, but only saprobism occurs in underground waters and in polluted waste waters. In this study a system is given by which trophism is shown in relation to saprobity. Data show that trophism as represented either by biomass (planktonic algae and chlorophyll) or by primary production of carbon per day or annually has a nearly hyperbolic function in regard to saprobity. In water bodies with a high degree of eutrophication, higher primary production is attained which is a supposition for qualitative changes within the communities according to progressive saprobic succession criteria. These findings contradict principles developed by Kolkwitz

(1935) which theorized synonymous saprovic and trophic levels for all waters. (Danovich-Wisconsin)
W80-01753

SUCCESSION OF ORGANISMS IN THREE-STAGE SEWAGE PONDS,
Institute of Meteorology and Water Management, Krakow (Poland).
J. K. Pudo.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1891-1896, 1 Fig, 9 Ref.

Descriptors: *Succession, *Poland, *Biological communities, *Sewage lagoons, *Plankton, Sewage, Chlamydomonas, Chlorella, Phytoplankton, Zooplankton, Productivity, Biomass, Biochemical oxygen demand, Oxygen, Sewage treatment, Sewage bacteria, Settling basins, Seasonal, Rotifers, Sewerage, Microorganisms.

Biological investigations of sewage ponds in Alexandrowice near Cracow, Poland, July 1972 to July 1973 show great variability in biological composition and quantity depending upon the method of feeding sewage to the ponds, biochemical changes, and seasons. This paper examines effectiveness of domestic waste treatment ponds and organism succession. Sewage is generated by a population of 410 inhabitants and ranges 38-86 cu m/d. Sewage treatment includes three ponds: pond I is anaerobic for suspended sludge sedimentation; pond II is artifically aerated with compressed air by blowers; and pond III is an oxidizing, algal pond. Sewage normally flows through all three ponds, however, pond I is sometimes omitted. Two algal bloom periods occur in summer-autumn and spring seasons. Bloom forming organisms such as Chlaymydomonas and Chlorella vulgaris are present in all ponds; Cryptomonas erosa is present only in pond III. Rotifers are also numerous with Brachionus urceolaris, B. calyciflours and Epiphanes senta dominating. In pond I rotifers grow gradually and reach a maximum (32 ind/cu cm) when water blooms ind. BOD is relatively high, 100 mg/1, in late summer-autumn and decreases to 17-38 mg/1 in winter. Pond I diatoms, Hantzschia amphioxys and Nitzxchia hungaria, are characteristic of alpha-mesosaprobic waters. BOD in pond II oscillates between 20 and 70 mg/1; pond III BOD keeps mostly below 10 mg/1. (Danovich-Wisconsin)
W80-01754

RATIO ATP/CHLOROPHYLL AS AN INDEX OF RIVERS' WATER QUALITY,
Instituto di Ricerca sulle Acque, Rome (Italy).
G. Chiaudani, and R. Pagnotta.
In: Proceedings: Congress in Denmark 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1897-1901. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Systematics, *Water quality, *Chlorophyll, *Tiber River(Italy), Water pollution, Chemical properties, Biochemical oxygen demand, Oxygen, Rivers, Italy, Organic matter, Organic loading, Organic wastes, Degradation(Decomposition), Waste assimilative capacity, Ammonium compounds.

This September 1975 to April 1976 study of a segment of the lower Tiber River, Italy, confirms that ATP/chlorophyll (Ch) ratios are useful for rapidly detecting water quality shifts in rivers where eutrophication or organic wastes are involved. The ATP/Ch method more accurately assesses water quality than biomass-chlorophyll ratios. Water quality is classified by the burden of organic, biologically decomposable substances; low to moderate, moderate to critical, and severly polluted. Main chemical parameters used as references are COD, ammonium content, and oxygen content. ATP/Ch ratio increases with ammonium concentration and COD while DO decreases with relation to increased organic load. Correlation coefficients are all highly significant for chemical parameters and mean ATP/Ch. In free-flowing rivers, ATP/Ch ratios (x 100) less than 10 indicate low to moderate pollution. Moderate to critical pollution is characterized by a ratio of 10-20. Severely polluted rivers have ATP/Ch ratios greater than 20. In cultured algae, values less than 10 characterize autotrophic conditions; with values more than 20, heterotrophic organisms prevail. Values ranging 10-20 indicate a succession of autotrophic conditions; with values more than 20, heterotrophic organisms prevail. Values ranging 10-20 indicate a succession of autotrophic towards heterotrophic conditions. (Danovich-Wisconsin)
W80-01755

COMPLEX SIMULTANEOUS ANALYSIS OF THE SAVA RIVER AT DIFFERENT HYDROLOGICAL CONDITIONS,
Hydrometeorological Inst. of Croatia, Zagreb (Yugoslavia).
N. Sostaric, B. Stilinovic, Z. Paveltic, and I. Matonickin.
In: Proceedings; Congress in Denamrk 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie. Vol 10, 1978, p 1902-1909.

Descriptors: *Sava River(Yugoslavia), *Waves(Water), *Dynamic programming, *Hydrologic aspects, *Rainfall, *Self-purification, *Streamflow, Yugoslavia, Phytoplankton, Zooplankton, Streams, Rivers, Bacteria, Currents(Water), Graphical analysis, Mathematical studies, Probability, Hydrograph analysis, Seston, Water pollution.

Simultaneous analysis of a single dynamic water volume during its course along a selected reach of the Sava River, Yugoslavia, with deterministic (on the reach) and statistic (on the profile) parameters was used to develop self-purification constants and coefficients for the river. The selected reach is 208.4 km long; it starts in mountains and levels off to a lowland watercourse. Rainfall and travelling wave effects on water parametets were observed. Rainy weather and river waves prevailed during the first simultaneous analysis in September 1976; during October 1976, stable weather with moderate rainfall in lowland areas occurred. Significant changes in suspended solids and KMn04 oxidability are caused by rainfall and the traveling wave. Relatively small increases in Ca, K, and Na content are caused by groundwater. Phytoplankton and zooplankton were determined; Sphaerotilis dominates. Other phytoseston groups include Cyanophyta (Lyngbya, Phoridium), Diatomae (Nitzchia, Synedra), and Rhodophyta (Chantransia). Zooseston include Cilliata such as Aspidisca lynceus and Carchesium polypinum and Flagellata. Tributaries such as the Zagreb, which is heavily polluted, increase Sava River biomass 5.75 times values immediately upstream. Bacteria decay coefficients show that increasing pollution causes (1) faster removal of heterotrophic and proteolytic bacteria, P-mineralizing bacteria, Escheri coli, and bacterial biomass, and (2) slower removal of nitrate-reducing bacteria, ammonifying bacteria and H2S-producing bacteria. (Danovich-Wisconsin)
W80-01756

SUCCESSION OF PHYTO- AND ZOOPLANKTON IN A WASTEWATER STORAGE RESERVOIR,
Mekorot Water Co., Tel Aviv (Israel).
J. Eren.
In: Proceedings: Congress in Denamrk 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 1926-1929.

Descriptors: *Phytoplankton, *Zooplankton, *Reservoirs, *Irrigation, *Water reuse, *Kfar Hasidim Reservoir(Israel).

Since Israel uses almost all its water resources, storage reservoirs filled with sewage effluent are being used for irrigation without causing environmental nuisances. Kfar Hasidim reservoir in northern Israel has an 8 ha area and average 6.5 m depth when full. Secondary treated effluents from Haifa sewage treatment plant were pumped into the reservoir during March; at the end of August only 1 m of water remained in the reservoir. The study investigated chemical and biological changes in the four month period. The reservoir contained 2.5 mg/1 dissolved oxygen during the storage period. BOD decreased from 60 to 9 mg/1 and COD from 230 to 118 mg/1 from Haifa sewage treatment plant to the reservoir, respectively. However undesirable odors were not recorded around the reservoir. After initial dense populations of Chlamydomonas and Euglena, algal density declines due to intense zooplankton grazing. Herbivorous zooplankton consist mainly of Daphnia and Brachinous and reach 780 ind/1 and 13,000 ind/1, respectively, in June. Algal biomass, mostly Ankistrodesmus, is 1-2 mg Dwt/1 during irrigation season. In August zooplankton decrease followed by a secondary algal bloom dominated first by Euglena and later by Spirulina. Secchi transparecney is 25 cm in April, 180-250 cm during June-July and only 10 cm in September. (Danovich-Wisconsin)
W80-01758

THE EFFECTS OF CHLORINE, ELEVATED TEMPERATURE AND EXPOSURE DURATION OF POWER PLANT EFFLUENTS ON LARVAL WHITE PERCH MORONE AMERICANA (GMELIN),
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
For primary bibliographic entry see Field 5A.
W80-01759

MOBILIZATION OF METALS FROM SEDIMENT BY NTA,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
H. E. Allen, and C. Boonlayangoor.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 1956-1962. 3 Fig, 11 Ref.

Descriptors: *Nitrilotriacetic acid, *Iron, *Sediments, *Chelation, *Chemical reactions, *Detergents, Metals, Chemicals, Copper, Nickel, Lead, Zinc, Water quality, Sewage effluents, Chemical wastes, Rivers, Sediment-water interfaces, Sewage treatment, Activated sludge, Suspended solids.

This laboratory study of US and European River sediment and water samples mixed with 0.05, 0.20, 0.75, 3.5, and 10.0 mg/1 H3NTA, concludes that NTA (trisodium salt of nitrilotriacetic acid) when used as a builder replacing phosphates in detergents, results in little or non-detectable metal mobilization from sediments. NTA concentrations extend from those typical of receiving waters to levels above environmental concentrations. Data from experiments using 100 g sediment/1 overestimate natural environment mobilization by tenfold and thereafter mobilized trace metals and phosphate concentrations typical of environmental conditions, iron is not mobilized or mobilized to only a slight extent. NTA peptizes colloidal ferric hydroxide which retards aggreagtion and allows iron to pass through 0.45 micro m membrane filters. Effluent from Canadian activated sludge sewage treatment plants contains 0.75 mg MTA/1; at this concentration metal mobilization occurred for copper in one sample, nickel in two samples, and zinc in one sample. Soluble NTA resulting from this concentration probably causes metal concentration increases of 10% or less. Diluting NTA to one-fourth that present in Canadian activated sludge sewage treatment plant effluents would probably result in metal concentration increases too small to be measured. (Danovich-Wisconsin)
W80-01762

DIET OF BROOK TROUT (SALVELINUS FINTINALIS MITCHELL) AND BROWN TROUT (SALMO TRUTTA L.) IN AN ALPINE STREAM,
Maryland Univ., College Park. Dept. of Zoology.
D. J. Allan.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 2045-2050, 1 Fig, 3 Tab, 9 Ref.

Descriptors: *Brown trout, *Brook trout, *Cement Creek(CO), *Fish diets, Fish food organisms, Foods, Diets, Mountains, Benthic fauna, Inverte-

brates, Population, Salmonids, Colorado, Aquatic drift, Predation, Diptera, Mayflies, Size, Larvae, Aquatic insects, Diurnal.

Salmonids, brook trout Salvelinus fontinalis and brown trout Salmo trutta, studied in Cement Creek, Colorado 5-6 August 1975, have similar food preferences; they feed most heavily on the most abundant prey and large size prey. The study compares prey eaten by brown trout to invertebrate abundance in drift and benthos. Cement Creek is a high elevation (3600-2602 m), stony bottom stream. Drift during the night exceeds drift during the day. Ephemeroptera nymphs and Diptera larvae dominate, together account for over 80% total drift. Ephemeroptera are the most abundant benthos. Both trout species consume most invertebrate taxa present in the stream. Prey number per trout are greatest in afternoon and evening hours, but some prey are observed in stomachs throughout the 24 h period. Ephemeroptera are less frequent in trout stomachs (20.4% day) and 40.5% night) for brook trout and 36.2% (day) and 66.7% (night) for brown trout than expected from drift (62.5%) and benthos (73.0%) frequency. Diptera larvae, emerging aquatic insects, and terrestrial items are more frequent in trout stomachs than in drift orbenthos. Brown trout differs from brook trout in consuming more Ephemeroptera and fewer Diptera; brown trout also prefer certain taxa which are relatively large but rare including Ephemerella, Rhithrogena, and Rhyacophila species. Larger nymphs of mayfly Baetis bicaudatus are much more heavily fed upon by trout than smaller nymphs. (Danovich-Wisconsin)
W80-01770

RISE AND COLLAPSE OF AN INTRODUCED FISH, MORNONE MISSISSIPPIENSIS IN CLEAR LAKE, IOWA,
Iowa State Univ., Ames. Dept of Animal Ecology.
K. D. Carlander.
In: Proceedings: Congress in Denmark 1977. Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 2051-2054, 4 Fig, 12 Ref.

Descriptors: *Yellow bass, *Clear Lake(IA), *Fish populations, *Fish populations, *Fish establishment, *Water level fluctuations, Size, Fish reproduction, Fish harvest, Growth rates, Competition, Droughts, Stress, Yellow perch, Freshwater fish, Bullheads, Sunfishes, Fisheries, *Iowa.

Per-day catch of average yellow bass, Morone mississippiensis, increased from 14 in 1947 to 26 in 1949 in Clear Lake, Iowa; catch was 54 and 65 per net-day from 1954-1959 (drought years) but increased to 114 in 1976. Aeromonas salmonicida almost eliminated yellow bass population in 1968 but since that time, the popylation has been slowly increasing. Clear Lake is a 1474 ha eutrophic lake with 6 m maximum depth and yellow bass were introduced 1930. In the late 1950s drought lake area shrank 8%. Beach seine samples indicate good yellow bass reproduction in 1950, 1951, 1954, 1956, 1965, and 1967. Year class strength is not correlated with reproductive success. MAximum sizes (from 290-190 mm) and growth decreased markedly in the 1940s and 1950s when yellow bass were the most abudnant lake species. When water levels increased after the drought, growth rate increased somewhat, but population density was still high. After reduction by epizootic, sizes and growth rates increased to levels similar to early 1940s. Yellow perch is most directly affected by yellow bass competion. Since 1947, yellow perch have not been abudnant and few were over 180 mm total length. However, perch catches in 1973 and 1974 are similar to those of yellow bass in mid 1960s. Perch increase did not immediately follow upon yellow bass decline. Black crappies and black bullheads both had successful year classes in 1968-1971. However, yellow perch growth rate increased immediately after the sharp decline in yellow bass numbers. (Danovich-Wisconsin)
W80-01771

FEEDING BEHAVIOR AND TERRESTRIAL LOCOMOTION IN THE CYPRINODONTID FISH, RIVULUS HARTII (BOULENGER),
University of Western Ontario, London. Dept. of Zoology.
For primary bibliographic entry see Field 8I.
W80-01772

EFFECT OF FISH (SALVELINUS ALPINUS, ARCTIC CHAR) PREDATION ON THE ZOOPLANKTON IN TEN NORWEGIAN LAKES,
Trondheim Univ. (Norway). Museum.
A. Langeland.
In: Proceedings: Congress in Denmark 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 2065-2069. 3 Fig, 16 Ref.

Descriptors: *Norway, *Lakes, *Zooplankton, *Fish food organisms, *Arctic char, *Daphnia, *Predation, Fish, Fish diets, Size, Weight, Invertebrates, Salmonids, Crustaceans, Benthic fauna, Aquatic insects, Population, Competition, Fisheries.

High densities of Arctic char have profound predation effects on the largest zooplankton species, Bythotrephes longimanus and Daphnia galeata, in 10 Norwegian lakes; the fish also affects prey species size. The lakes, with 0.4 to 58 sq km surface areas and 15 to 204 maximum depths, are situated in Trondelag, Central Norway. Arctic char prefer Cladocernas rather than Copepods and main prey species inclde Daphnia galeata, Bythotrephes longimanus, Bosmina longispina. and holopedium gibberum. Stomach contents also include benthic invertebrates and surface-caught insects. D. galeata is the most important prey species; it ranges 0-75% zooplankton biomass in the 10 lakes and is most abundant (800-7000 per cu m) in the five lakes with highest arctic char mean weights. High char densities cause low D. galeata densities; predation also explains B. longimanus absence. B. longimanus has been completely eliminated in some lakes due to predation. Where D. galeata densities are less than 0.2-0.8 ind/1, the zooplankton are no longer available as food for a arctic char and D. cristata, a smaller species, replaces it. In lakes with highest predation pressure, mean adult D. galeata size also decreases. B. longispina displays an opposite pattern from D. galeata and B. longimanus, with higher predation densities and relatively greater importance as food in lakes with lowest mean arctic char weight. (Danovich-Wisconsin)
W80-01773

REMARKABLE YIELD OF BROWN TROUT (SALMO TRUTTA L.) IN LAKES NEAR THE HARDANGER GLACIER, NORWAY,
Trondheim Univ. (Norway). Museum.
J. W. Jensen.
In: Proceedings: Congress in Denmark 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20 1978, p 2070-2075. 1 Fig, 4 Tab, 14 Ref.

Descriptors: *Brown trout, *Fish populations, *Hardanger glacier(Norway), *Growth rates, *Oligotrophy, Population, Norway, Lakes, Water chemistry, Melt water, Glaciers, Snowmelt, Biological communities, Salmonids, Fish food organisms, Fish diets, Fish harvest, Fishing, Fish establishment, Fish physiology, Crustaceans, Plankton, Fisheries.

Surveys in 1975-1976 of 20 lakes in Hardanger, Norway reveal total catches of 709 brown trout (Salmo trutta L.), the only fish species in these lakes. Hardanger glacier in southern Norway, is 95 sq km and the fifth largest in Norway; its lakes lie between 832 and 1348 m a.s.1. in three different river systems and range 5-250 ha. Water has extremely low ionic contents, 5.5-5.7 pH, and 0.5-20 m Secchi depth. Five crustacean species occur: Eubosmina longispina and Cyclops Scutifer dominate. In river system 1, trout catches vary from 633 to 1715 g. In the main course of river system 2, only three fish were taken. Lake 2a, in a tributary, yields 2337 g. Lake 3a yields 1618 g and 3b, 720 g. Eight lakes have no fish. Lowest altitude lakes show 4.6-5.4 annual trout growth, the highest in the river systems. Some 30% of the trout weigh more than 300 g. River system 1 trout with two months open water and 5-8 C temperatures, grow 4.0-4.6 cm in dense populations; these season growth rates are more than twice normal values. All physical and chemical conditions show minor primary production; macrophytes do not even occur. Trout apparently exploit all available food sources; stomachs contain relatively few prey. In lake 3b, annual yield is estimated at 4 kg/ha. Long periods with 0.5 m Secchi depth cause negligible primary productivity; fish production is probably entirely based on allochthonous material. (Danovich-Wisconsin)
W80-01774

EVALUATION OF THE CRITICAL THERMAL MAXIMUM FOR DETERMINING THERMAL TOLERANCE OF FRESHWATER FISH,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5A.
W80-01775

VERTICAL DISTRIBUTION OF FISHES IN ONE LAKE DEEP (LAKE KUUSVESI, CENTRAL FINLAND),
Jyvaskyla Univ. (Finland). Dept. of Hydrobiology.
P. Eloranta, and A. Eloranta.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 2092-2097. 6 Fig, 2 Tab, 2 Ref.

Descriptors: *Lake Kuusvesi(Finland), *Fish migration, *Vertical migration, *Seasonal, *Oligotrophy, Fish, Distribution, Distribution, Distribution patterns, Ecological distribution, Depth, Fish populations, Perches, Sunfishes, Killifishes, Bottom fish, Testing procedures, Fish harvest, Fisheries, *Finland.

Results of vertical fishing compared to normal test fishing during summer and autum 1976 in oligotrophic Lake Kuusvesi, central Finland, show fish movement from shallow littoral waters to deep waters in autumn. Lake Kuusvesi has 3.7 m mean depth and 6.9 pH. Most abundant fish species includes roach (Rutilus rutilus), perch (Perca fluviatilis), bream (Abramis brama), white bream (Blicca bjoerkna), ruffe (Acerina cernua), and bleak (Alburnus alburnus). Total catch during vertical fishing was 7,677 fish including perch 35.2%, mean weight (mwt) 25.3 g; roach 31.9%, mwt 37.0 g; white bream 11.4% mwt 18.0 g; vendace 10%, mwt 30.6 g; ruffe 8.7%, mwt 9.7 g; and six other species. July mean catch/net/d (all nets) was 5.0 with surficial nets having highest individual mean value, 12.7 fish. August mean catch/net/d (all nets) was 6.3 with bottom nets having highest individual mean value, 15.0 fish. Autumn mean catch in vertical nets was higher than summer values, being 52.2/net/d, with bottom nets having highest individual mean catch, 122.1 fish. Perch occur abundantly in warm surface waters in summer and move to deeper bottom waters in autum. Roach are evenly distributed. Ruffe, white bream, burbot, and bream inhabit bottom water layers during the entire study period. During summer, catch/net/d for normal fish testing is 4.5 to 7.4 times vertical net catches. In autumn, catch/net/d of vertical nets is twice that of test fishing, making it difficult to obtain correct proportions of different fish species. (Danovich-Wisconsin)
W80-01777

TOXICITY AND BIOCONCENTRATION OF EPN AND LEPTOPHOS TO SELECTED ESTUARINE ANIMALS,
Environmental Research Lab., Guld Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-01778

POPULATION STUDIES OF VENDACE (COREGONUS ALBULA (L.) AND PERCH (PERCA FLUVIATILIS L.) IN A MESOHUMIC OLIGOTROPHIC LAKE,
Joensuu Univ. (Finland). Karelian Inst.
M. Viljanen.
In: Proceedings: Congress in Demark 1977 Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20 1978, p 2103-2110. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Fish populations, *Perches, *Salmonids, *Analytical techniques, *Lake Suomunjarvi(Finland), Fish, Biomass, Distribution, Finland, Scuba diving, Marking techniques, Capture-mark-and-recapture technique, Nets, Dominant organisms, Growth stges, Age, Fish harvest, Number fish per acre, Density, Oligotrophy, Fisheries.

The most important findings of density and population biomass studes of vendance (Coregonus albula) and perch (Perca fluviatilis) in Lake Suomunjarvi, eastern Finland, 1974-1977 are the large perch population fluctuation in Lapinlathi Bay, similarity of diving results at different sites and different years, and similarity of population estimates by scuba diving and mark-recapture methods. Analytical techniques include a combinations of mark-recapture and scuba diving with regard to perch, and mark-recapture and seining-area method with regard to vendace. Suomunjarvi is a mesohumic oligotrophic lake with 650 ha area, 5.7 mean depth, and 27 m maximum depth. Most numerous fish species are vendance (31% of biomass), perch (26.5%) and whitefish (14.1%). in 1975-1977, 46,502 (1+) and 3,450 (>or=2+) total vendance were caught, 9,109 (1+) and 897 (>or =2+) were marked and released, and 182 (1+) and 42 (>or =2+) marked fish were recaptured. Density fluctuated 520-3,290 (1+) and 148-187 ind/ha (>or =2+) and biomass 7.9-19-4 (1+) and 5.3-6.7 kg/ha (>or =2+) depending on year, lake area, and method. Mean vendace catch for 1974-1976 was 1.6 kg/ha/yr. Both mark-recapture and scuba diving methods give almost identical perch results. Mark-recapture experiments (1975-1976) in Lapinlahti Bay show 2,058 perch (>or =2;) caught, 1,994 marked and relesed, and 336 marked fish recaptured. Perch population in Lapinlahti Bay in 1975 were 3,560 or 224 ind/ha and in 1976, 910 or 57 ind/ha. Biomass was 8850 kg or 13.6 kg/ha. (Danovich-Wisconsin)
W80-01779

PETROLEUM IN DEEP BENTHIC ECOSYSTEMS OF THE GULF OF MEXICO AND CARIBBEAN SEA,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W80-01780

IMPOUNDMENTS AND THEIR INFLUENCE ON THE RIVERS STUDIED BY BIOASSAYS,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
M. Bombowna, H. Bucka, and W. Huk.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, p 1629-1633, 1978. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Bioassay, *Eutrophication, *Reservoirs, *Poland, Impoundments, Algae, Diatoms, Water pollution sources, Growth rates, Population, Curves, Phosphates, Nitrates, Nutrients, Nutrients loading, Mathematical studies, Equation, Environmental effects, Primary productivity.

Water flowing in and out of the Goczalkowice, Roznow, and Tresna reservoirs in Poland showed higher eutrophication levels than the Solina impoundment in 1973-74. Carpathian Mountain rivers drain one-tenth of Poland; however, their impoundments supply over 30% of total water resources. Agricultural wastes are the primary cause of eutrophication, with municipal and industrial waste effects secondary. In spring the greatest leads flow into the impoundments. Phosphates are the limiting factor with nitrates in excess. Diatoms such as Cyabella ventricosa, Cyclotella, Navicula, and Diatoma vulgare are dominant, with lesser quantitites of green algae, blue-green algae, and chrysophytes. The greatest fertility is in Goczalkowice impoundment. Green algae are more numerous above impoundments; whereas diatoms grow better below impoundments. Chlorophyll-a content in the green algae; diatoms ratio is 83:38 above impoundments and 71:44 micro g 1 below them. Above impoundments, primary production is 0.82 for green algae and 0.40 mg 02 1 h for diatoms, below impoundments, 0.45 and 0.83 mg 01 1 h, respectively. One positive effect of these impoundments is the decreased number of green algae below impoundments with better diatom development; therefore, impoundments enhance microorganism succession typical for mountain rivers. (Danovich-Wisconsin)
W80-01781

RELATIONSHIPS AMONG BIOLOGICAL AND PHYSIOCHEMICAL PARAMETERS IN SPANISH RESERVOIRS,
Instituto de Investigaciones Pesqueras, Barcelona (Spain).
M. Estrada.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978. p 1642-1646. 4 Fig, 5 Ref.

Descriptors: *Reservoirs, *Physicochemical properties, *Water chemistry, *Geographical regions, *Spain, Chemical properties, Mathematical studies, Nitrates, Phosphates, Biological properties, Water properties, Water types, Hardness, Silica, Chlorophyll, Lentic environment, Geologic control, Mineral water, Impoundments.

Relationships of water quality parameters in 100 Spanish reservoirs explain general phenomena; however, on a more localized scale relationships vary enough to require that individual species of organizms in each reservoir must be separately considered. Four surveys 1972-1975 sought data on plant pigments and physiochemistry. principal components for stratification and mixing data are water mineralization and biological activity. The geograhical distribution of the latter component shows some regularities but these are difficult to interpret. Reservoir waters in northwest and western Spain have low mineral content due to siliceous rocks; central and eastern Spanish reservoirs have high mineral content because soluble limestones are abundant. Alkalinity and chlorophyll relationships are not simple; chlorophyll content is low in extremely soft water reservoirs, but increases with alkalinity only up to intermediate ranges one meg l. Phytoplankton photosynthetic activity plays a major role in CaC03 precipitation, by depleting C02 and elevating pH values. Nitrate concentrations are higher in more-mineralized eastern Spanish reservoirs; however, phosphate concentrations are lower because its precipitation is more intense. Chlorophyll content during stratification periods, when algal growth is more active correlates significantly with phosphate concentration, suggesting its importance in controlling phytoplankton biomass. (Danovich-Wisconsin)
W80-01782

ZOOPLANKTON CRUSTACEANS IN SPANISH RESERVOIRS,
Barcelona Univ. (Spain). Dept of Ecologia.
J. Armengol.
In: Proceedings: Congress in Denmark 1977, Part 3: Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20 1978. p 1652-1656, 2 Fig, 1 Tab, 1 Ref.

Descriptors: *Reservoirs, *Zooplankton, *Classification, *Trophic level, *Correlation analysis, *Spain, Crustacean, Copepods, Invertebrates, Speciation, Variability, Mathematical studies, Graphical analysis, Curves, Ecosystems, Eutrophication, Mestrophy, Oligotrophy, Impoundments.

Principal coordinates and similarity matrices were used to analyze zooplankton crustaceans in relation to reservoir classifications in 104 Spanish reservoirs. Although analytical results are inconclusive, axes are well correlated with species distribution and reservoir classifications established by Margalef and Estrada. The first axis correlates perfectly with species abundance; the second axis relates to parameters regarding water mineralization; the third axis is associated with parameters indicating trophic levels. The second and third axes form species classification according to principal environmental characteristics. Five groups were established. Group I includes the commonest species such as Bosmina longirostria, Ceriodaphnia pulchella, Diaphanosma brachyurum, and Daphnia longispina, and does not have very defined environmental preferences. Group II, characterized by heavily mineralized waters and moderate eutrophy, comprises Daphnia magna, Lovenula alluadi, and Ceriodaphnia reticulata. Group III includes Daphnia parvula and Copidiaptomus steueri species in mineralized and eutrophic waters. Groups IV and V correspond to reservoirs with acid waters; the fourth is most eutrophic and formed by Thermocyclops dybowskii plus Alona quadragularis and Paracyclops fimbriatus. The fifth corresponds to moderately eutrophic reservoirs in which Diatomus castaneti, Megacyclops viridis, and Eurycercus lamellatus appear. (Danovich-Wisconsin)
W80-01783

HISTORICAL AND ECOLOGICAL FACTORS CONCURRING IN THE DISTRIBUTION, BIOMETRY AND FERTILITY OF PLANKTONIC CRUSTACEANS IN PYRENEAN LAKES,
Barcelona Univ. (Spain). Dept. of Ecologia.
M. R. Miracle.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1657-1663. 1 Fig, 2 Tab, 19 Ref.

Descriptors: *Lakes, *Crustaceans, *Zooplankton, *Population, *Distribution, *Pyrenees, Spain, Invertebrates, Plankton, Copepods, Physicochemical properties, Trophic level, Water properties, Biological communities, Fertility, Standing crops, Primary productivity, Pyrenees mountains, Distribution patterns, Ecological distribution, Habitats, Environmental effects.

This July-August 1974 study of 50 lakes in the eastern half of the Spanish Pyrenees Mountains includes that distribution, morphometry, and biology of planktonic crustacea cannot be explained solely by alkalinity, temperature, trophic state, and fish predation factors; water flux, stability, size, and environmental isolation must also be considered. Crustacean species composition is uniform with Cyclops abyssorum and Daphnia longispina occurring in most lakes. Among euplanktonic species, five community types are found: (1) without diaptomids; (2) with small diaptomids; (3) with bigger diaptomids; (4) with two different size diaptomids; and (5) astatic waters with anostracan. Areas, depths, trophic levels and salmoid presence have wide ranges for lakes. Alkalinity does account for vicarious diaptomid distributions. E. vulgaris occurs in 0.04-1.2 meq 1 alkalinities whereas M. laciniatus does not occur in alkaline waters. Genus Diaptomus occurs only in Pyrenean lakes and not in Alpine or other European lakes. Copepods show important size and fertility differences as adaptations to ecological conditions. Temperature clearly affects C. abyssorum size; however, diaptomids are independent of this factor. Trophic level affects size variablity in both copepod groups. Body length variance corresponds with Secchi disc and chlorophyll contents. Relations between male abundance and size exist in C. abyssorum populations. Water flux also influences fertility. (Danovich-Wisconsin)
W80-01784

COMPOSITION AND DYNAMICS OF ZOOPLANKTON IN THE SAVA LAKE,
Institute for Biological Research, Belgrad (Yugoslavia).
V. Kalafatic.
In: Proceedings: Congress in Denmark 1977, Part 3: Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1664-1666, 1 Fig, 1 Tab.

Descriptors: *Zooplankton, *Productivity, *Copepods, *Ecological distribution, *Larvae, *Sava Lake(Yugoslavia), Yugoslavia, Secondary productivity, Biomass, Standing crops, Lakes, Seasonal, Larval growth stage, Rotifiers, Daphnia, Aquatic life, Plankton, Invertebrates.

Zooplankton of Sava Lake, Yugoslavia are the Cladocera-Copepoda type, characterized by high production and remarkable species dynamics; how-

ever, the most diversified group are Rotatoria, which includes 59% of all recorded species. This 1974 study examined zooplankton structure and dynamics in relation to ecological factors. Damming up the Sava River, principal tributary of the Danube, forms Sava Lake, four km in length, 80 m wide, and 12 m maximum depth. Bosmina longirostris, B. coregoni Daphnia cucculata, and D. longispina are characteristic Cladocera species exhibiting high population density in spring and summer. Bosmina coregoni coregoni is a rare and scattered species which normally prefers large water bodies. It reaches Sava Lake in September with 20.9 ind 1, becoming the dominant zooplankton species. Seven Copepoda species make up 15% of total zooplankton species. Eudiaptomus gracilis is the only diaptomid recorded. In the one-year investigation, two vernal and one aestival zooplankton production peaks occurred. First peak occurred in March and amounted 36.6 ind 1. Larval Copepoda stages averaged 27.7 ind 1. Zooplankton production in May reached 51.0 ind 1. The third peak occurred in August and amounted 27.3 ind 1. Minimum zooplankton numbers were recorded in winter and averaged 5.2 ind 1 in October. Larval Copepoda stages are particularly important with production peaks corresponding to peak larval Copepoda numbers. (Danovich-Wisconsin)
W80-01785

SEDIMENTATION PROCESS ABOVE THE ASWAN HIGH DAM IN LAKE NASSER-NUBIA (EGYPT-SUDAN),
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
B. Entz.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte, Limnologie, Vol 20, 1978, p 1667-1671. 6 Fig, 6 Ref.

Descriptors: *Dams, *Sedimentation, *Deposition(Sediments), *Environmental effects, *Aswan High Dam, Impoudments, Egypt, Nile River, Floods, Lakes, Sediment rates, Sediment distribution, Reservoir silting, Sediment discharge, Water levels, Flutuations, Flow, Biological communities, Indicators, Africa.

If Sedimentation continues unidisturbed, Lake Nasser, formed by the Aswan High Dam, Egypt, would not be completely filled for 1700 years; however, strong water level fluctuations and floods could markedly reduce filling time. This 1973 echo-sounding study investigated depths of new sediments. No durable deposits have been formed previously in the swift Nile River; however, as soon as the river widens, at 390 km form the dam, sedimentation starts immediately. Sedimentation occurred between 420 and 290 km with its peak at 350 km where the narrow semi-riverine section widens to 4-10 km wide forming a long lacustrine section near Wadi Halfa. Sedimentation between 400 and 356 km takes place at the old channel edge, decreasing gradually towards shore. Sedimentation under lacustrine circumstances is quite different (356-310 km). The old river bed is completely filled with new sediments, forming a smooth and almost horizontal silty bottom. Reservoir filling by mud will not be complete where main currents pass. A channel 10 to 12 m deep, as usual on riverine Nile sections, will be maintained. The New Nile will flow between newly formed mud banks. The sedimentation peak is gradually moving northwards. Mussels and sediment color are two useful biological indicators. Mussels in benthos exist in the same density as before in semiriverine sections; however, in lacustrine sections they are replaced by tubificids, up to 200 g sqm. Sediment color is brownish grey in upper parts, yellow in middle (lacustrine) and grey turning black near High Dam. (Danovich-Wisconsin)
W80-01786

OBSERVATIONS ON PHYTOPLANKTON AND PRIMARY PRODUCTIVITY IN VOLTA LAKE, GHANA,
Nigeria Univ., Nsukka.
S. Biswas.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1672-1676, 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Primary productivity, *Phytoplankton, *Population, *Chemical analysis, *Volta Lake, Ghana, Productivity, Ghana, Lakes, Plankton, Transparency, Temperature, Thermal stratification, Distribution, Methodology, Testing procedures, Analytical techniques, Evaluation, Water analysis, Africa.

In this 1970-71 study of phytoplankton primary productivity and population on Volta Lake, Ghana, phytoplankton varied with depth, making it impossible to obtain primary productivity data strictly according to homogeneous distribution rules; primary productivity therefore was calculated from chemical data alone. Both phytoplankton and oxygen were estimated from acidified samples treated with Winkler's reagents. The lake is not always fully homothermal and even when it is, vertical phytoplankton distribution is not necessarily homogeneous. Phytoplankton varies rapidly with oxygen. Secchi disk transparency decreases with phytoplankton increase. Progressive primary productivity decrease was observed from the lower to upper lake levels, relating phytoplankton population changes from a rising to declining phase in this lake. Using dark bottles for estimating oxygen, respiration loss is untenable due to phytoplankton decrease by death. Estimating primary productivity by direct free lake water methods is better than experimental methods due to restrictive bottle conditions. Integrated oxygen production in free lake water columns include respiration loss at non-photic depths; therefore, computed results are as good as net production. (Danovich-Wisconsin)
W80-01787

DIURNAL VERTICAL DISTRIBUTION OF ZOOPLANKTON DURING STRATIFICATION IN KAINJI LAKE, NIGERIA,
Kainji Lake Research Inst. New Bussa (Nigeria).
H. A. Adeniji.
In: Proceedings: Congress in Denmark 1977, part 3, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 1677-1683, 9 Fig, 1 Tab, 9 Ref.

Descriptors: *Zooplankton, *Distribution, *Diel migration, *Distribution patterns, *Kainji, Lake Nigeria, Lakes, Thermocline, Hypolimnion, Epilimnion, Temperature, Ecological distribution, Rotifers, Copepods, Crustaceans, Phytoplankton, Light intensity, Light, Predation, Migration, Diurnal.

Many factors control diurnal vertical zooplankton migration in Kaniji Lake, Nigeria, including light intensity, water temperature, dissolved oxygen, food, reproduction responses, and predation avoidance. According to an April 1974 study, the lake's water column showed a thermocline between five and 10 m and a hypolimnion of 20-30 m. Oxygen content is 7.0 mg 21 near the surface but drops to 0.5mg 1 at 10 m; pH in epilimnion and thermocline layers is 7.0-7.4, but is in the acidic range, 6.6-6.8, in the hypolimnion. Zooplankton migrate to surface waters at dusk and then migrate downwards in the morning to 4 m depths. By noon they migrate to 8-10 m depths. Cladocera and Copepods are absent in the top 4 m at noon, avoiding solar brightness and high surface water temperatures. The thermocline, where zooplankton congregate at noon, has lower temperatures than surface waters; cooler temperatures are also associated with maximum reproductive potential. Rotifers are abundant in surface waters at noon when crustaceans are absent, indicating predation pressure response. Changes in light intensity are the major control in diurnal vertical migration. A diurnal vertical phytoplankton migration to surface waters at night also occurs. (Danovich-Wisconsin)
W80-01788

LARVAL SPOTTED SEATROUT (CYNOSCION NEBULOSUS) A BIOASSAY SUBJECT FOR THE MARINE SUBTROPICS,
National Marine Fisheries Service, Port Aransas, TX. Southwest Fisheries Center.
A. G. Johnson, T. D. Williams, J. F. Messinger, III, and C. R. Arnold.
Contributions in Marine Science, Vol 22, p 57-62, 1979. 2 Tab, 16 Ref.

Descriptors: *Toxicity, *Oil, *Trout, Bioassay, Larval growth stage, Growth stages, Water quality, Water chemistry, Mortality, Mode of action, Fish physiology, Length, Fish behavior, Fuels, Organic compounds, *Cynoscion, *Seatrout, *Crude oil, *Mutagens, *Teratogens.

Larval spotted sea trout were selected as the test subject because specimens can be produced under laboratory conditions throughout the year by adjusting the temperature and photoperiod. Tests were made to determine the sensitivity of spotted sea trout larvae to water samples from different environments and to Baton Rouge No. 2 fuel oil Considerable variation in water quality was found within a small area with regard to larval mortality. Sublethal fuel oil concentrations (0.00-1.00 ppm) produced a general decrease in total body length and critical distance. An increase in unpigmented eyes occurred with an increase in fuel oil concentrations. (Deal-EIS)
W80-01840

HEAT RECIRCULATION INDUCED BY THERMAL DIFFUSERS,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B
W80-01879

THE EFFECT OF NICKEL ON THE GROWTH OF THE FRESHWATER DIATOM NAVICULA PELLICULOSA,
Notre Dame Univ., IN. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-01897

(GROWTH AND CHEMICAL COMPOSITION OF REED (PHRAGMITES AUSTRALLIS) AS RELATED TO WATER EUTROPHICATION), WACHSTUM UND CHEMISCHE ZUSAMMENSETZUG VON SCHILF (PHRAGMITES AUSTRALIS) IN ABHANGIGKEIT VON DER GEWASSEREULTROPHIERUNG.
Technische Univ., Berlin (Germany, F.R.). Inst. fuer Okologie.
F. Raghi-Atri, and R. Bornkamm.
Archiv fue Hydrobiologic, Vol 85, No 2, p 192-228, March, 1979. English summary and abstract. 5 Fig, 8 Tab, 89 Ref.

Descriptors: *Rooted aquatic plants, *Elements, *Eutrophication, *Effects, Plant morphology, Wetlands, Aquatic plants, Vegetation, Water quality, Nitrogen, Calcium, Potassium.

In order to evaluate the influence of water eutrophication on the development of the reed plant (Phragmites australis), at eight experimental plots within Berlin, the chemical composition of surface water, river-lake deposits and pore water have been investigated in relation to growth and chemical constituents of Phragmites. Regarding the performance of reed with increasing eutrophication the following reactions have been observed: (1) larger leaf area, (2) higher reduction of shoot number during the vegetation period, (3) increased contents of calcium and ash connected with decreased K:Ca ratio, (4) increased soluble N content in the whole plant, increased total N content in the stem. (Stihler-Mass)
W80-01913

ASPECTS OF THE ECOLOGY AND PHYSIOLOGY OF FRESHWATER MACROPHYTES: PHOSPHORUS CYCLING BY FRESHWATER MACROPHYTES: THE CASE OF SHAGAWA LAKE,
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 2H.
W80-01914

UPTAKE OF RADIONUCLIDES BY SOME AQUATIC MACROPHYTES OF ISMAILIA CANAL, EGYPT,

Atomic Energy Establishment, Cairo (Egypt). Radiation Protection Dept.
W. E. Y. Abdelmalik, R. M. K. El-Shinawy, M. M. Ishak, and K. A. Mahmoud.
Hydrobiologia, Vol 42, No 1, p 3-12, July 6, 1973. 5 Tab, 10 Ref.

Descriptors: *Radioisotopes, *Aquatic plants, *Bioindicators, Strontium radioisotopes, Phosphorus radioisotopes, Ismailia Canal, Egypt, Aquatic ecology.

Uptake of the radionuclides Co-60, Cs-134, Sr-89 and P-32, by different aquatic plants present in Ismailia Canal was found to increase at increasing initial concentrations of the radionuclides in the water. Maximum uptake was reached by most of the aquatic plants after different periods of contamination, ranging from 1 to 4 days. Certophyllum was found to be the most favorable biological indicator for strontium radioisotopes in concentrations ranging from 0.5 to 10 micron Ci/1 and for contamination periods up to 16 days. Elodea was found to serve as a biological indicator for either strontium mor phosphorus radioisotopes for limited contamination periods of 2 to 16 days for Sr and to 2 days for P isotopes. Potamogeton was also found to serve as a biologial indicator for limited contamination periods for strontium, phosphorus and cesium radioisotopes: 0 to 2 days for Sr, 2 to 16 days for P and 0 to 2 days for Cs isotopes. (Hinkel-Mass)
W80-01925

FIRE AND STREAM ECOLOGY IN SOME YELLOWSTONE LAKE TRIBUTARIES,
Humboldt State Univ., Arcata, CA.
D. P. Albin.
California Fish and Game, Vol 65, No 4, p 216-238, 1979. 7 Fig, 7 Tab, 21 Ref.

Descriptors: *Forest fires, *Forest management, *Streams, Watersheds management, National Parks, Streamflow, Stream erosion, Water temperature, Cutthroat trout, Fry, Runoff, Benthic fauna, Seasonal, Periphyton, Sediment transport, Yellowstone Lake, Yellowstone National Park.

This study attempted to clarify some effects of forest fires on streams in selected tributaries to Yellowstone Lake, Yellowstone National Park, in partial evaluation of the Park's natural burn fire management policy. In a stream in a watershed burned 45 and 36 years ago (Passage Creek) some changes were found, when compared to a similar stream in an unburned adjacent watershed (Chipmunk Creek). Summer stream temperatures averaged about 1.5C higher in Passage Creek. Streamflow showed a greater seasonal fluctuation and a higher water yield in Passage Creek. Water quality conditions in both streams were similar, but mineral export was greater in Passage Creek due to greater water yield. Aufwuchs accumulation on artificial substrates showed no significant difference between the two streams. Benthic sampling suggested a general increase in benthic macroinvertebrates in Passage Creek. The fry of Yellowstone cutthroat trout, Salmo clarki lewisi, appeared to emerge from the gravel earlier in Passage Creek than in Chipmunk Creek. Based on stream temperature differences, the difference in egg incubation time was calculated to be 4 days. Two other streams were studied during and immediately after a fire burned their watersheds. No harmful effects were found. Concentrations of calcium, magnesium, potassium, chloride, sulfate, phosphate, and total organic carbon were raised somewhat during a rainstorm, apparently as a result of ash leached into surface runoff. (Deal-EIS)
W80-01943

EFFECTS OF THE PIPELINE HAUL ROAD ON NEARBY PONDS AND LAKES ACROSS ALASKA'S NORTH SLOPE,
Alaska Univ., Fairbanks. Inst. of Marine Science.
V. Alexander, and M. C. Miller.
Report RLO-2229-T9-2, 1977. 104 p, 7 Fig, 17 Tab, 5 Ref, 2 Append. E(45-1)-2229.

Descriptors: *Roads, *Dusts, *Environmental effects, *Primary productivity, *Ponds, *Alaska, *Pipelines, Nutrients, Bioassay, Productivity, Granules, Highway effects, Roadbanks, Lakes, Oil industry, Leaching, Biomass, Oligotrophy.

In ponds within 0-5 m of haul roads servicing the Trans-Alaskan pipeline, significant annual productivity increases are observed due to settling road dust. During summer 1976, dustfall levels were monitored along coastal plain and foothills province transects. Road dust decreases from 1.5 to 12 g/sq m/d 10 m from road margins to 0.05 to 0.5 g/sq m/d at 300 m distance. Ponds created by road construction have the highest production rates (73.7 mg C/cu m/d) and algal biomasses (2.80 micro g chl/l). Leachates, from dust settled onto water surfaces, double algal biomass in nitrogen and phosphorus limited algal populations. These biomass increases are still within oligotrophic ranges. However, distances do not relate to any stimulation pattern. Closest pans received most dust material and have the highest biomass. Increasing road distance and decreasing total weight dust added to carboys does not result in stimulation depression. Finest dust fractions less than 1-2 micro m diameter may be responsible for biomass stimulation; these particles have the highest surface area per unit volume. Chemical and biological changes such as increasing alkalinity, nutrient concentrations, and water staining with brown dissolved humic materials, continue in newly formed ponds, especially in ones formed over terrestrial sedge communities. (Danovich-Wisconsin)
W80-01975

BLUE-GREEN ALGAL GROWTH AND SPORULATION IN RESPONSE TO SIMULATED SURFACE BLOOM CONDITIONS,
London Univ. (England). Dept. of Botany.
J. A. Rother, and P. Fay.
British Physiological Journal, Vol 14, No 1, p 59-68, 1979. 5 Tab, 29 Ref.

Descriptors: *Growth rates, *Cyanophyta, *Germination, *Plant physiology, Algae, Eutrophication, Reproduction, Aphanizomenon flos-aquae, Metabolism, Light, Light intensity, Environmental effects, Nitrates, Spores, Environmental effects, Physiological ecology, Plant growth, United Kingdom.

Sportulation in laboratory batch cultures does not appear until terminal growth stages, except one Aphanizomenon flos-aquae strain in HEPES-buffered media displayed akinetes when still actively growing. Growth and differetiation of unialgal isolates and natural Aphanizomenon flos-aquae populations from North Salop, England were investigated under laboratory conditions. Nutrients, buffer, light intensity environmental effects were examined. Di-peptide buffer N-glycyl-glycine at 0.5 g/l inhibits both heterocyst formation and sporulation whereas high nitrate concentrations (400 mg/l) reduces heterocyst frequency by only 50%. HEPES buffer has little effect on agal growth but stimulates akinete production and heterocyst frequency. Filtrates from sporulating and non-sporulating cultures do not stimulate sporulation. Algal cultures stop growing before terminal stages with low orthophosphate concentrations. At 10 mg/l orthophosphate inhibits sporulation, however, growth is not suppressed. Trace elements mixtures containing Mn, Zn, Co, Cu and Mo salts and chelated and unchelated iron do not induce sporulation rates greater than those in control cultures, although growth is reduced. Cultures in darkness or high light intensities, eight kix and above, do not grow or sporulate. Treatment with uv light does not encourage sporulation. With N-glycyl-glycine, A. flos-aquae cultures do not sporulate and heterocyst formation is suppressed, suggesting a relationship between heterocysts and akinetes. (Danovich-Wisconsin)
W80-01977

BROWSING AND GRAZING BY CLADOCERAN FILTER FEEDERS,
McGill Univ., Montreal (Quebec). Dept. of Biology.
P. A. Horton, M. Rowan, K. E. Webster, and R. H. Peters.
Canadian Journal of Zoology, Vol 57, No 1, p 206-212, 1979. 3 Fig, 2 Tab, 33 Ref.

Descriptors: *Animal behavior, *Daphnia, *Grazing, *Browse utilization, *Food habits, Zooplankton, Food abundance, Light, Light intensity, Productivity, Reproduction, Invertebrates, Biomass, Standing crops, Physiological aspects, Secondary productivity, Competition, Seston.

If planktonic food amounts are low, Daphnia magna and Daphnia pulex utilize sedimented material, giving these animals competitive advantage over other Cladocera such as Daphnia galeata and Ceriodaphnia quadrangula which feed solely on suspended food. This laboratory study relates suspended food concentration to feeding shifts from browsing to grazing by Daphnia pulex; three other cladocerans were examined to determine if feeding site choice is a relatively constant food level function among planktonic animals. D. pulex mainly forages in sediments when Scenedesmus food additions are less than 10,000 cells/ml. Even at low food levels, 20% to 40% of the animals swim into upper strata while others sink slowly to bottom again, indicating a preference for browsing rather than grazing. The shift is most pronounced in 10,000 to 100,000 cells/ml range; swimming animals numbers triple prefeeding density numbers. At higher food concentrations, swimming animal numbers decline. D. pulex is also very positively phototactic at high suspended food levels. Below 10,000 cells/ml, filtering rates are high but little food is collected. With increasing food, filtration rate is depressed but the ingestion rate remains constant. D. pulex does not sustain itself at 10,000 cells/ml; brood size falls to zero. At 25,000 cells/ml, brood sizes are close to maximum; when suspended food concentration falls below subsistence levels, D. pulex and D. magna cease to graze and instead browse. Neither D. galeata nor C. quadrangula show significant positional response to low food concentrations. (Danovich-Wisconsin)
W80-01978

AN INVESTIGATION OF DROUGHT AVOIDANCE IN INTERTIDAL FUCOID ALGAE,
Glasgow Univ. (Scotland). Dept. of Botany.
M. W. Schonbeck, and T. A. Norton.
Botanica Marina, Vol 22, No 3, p 133-144, 1979. 6 Fig, 6 Tab, 20 Ref.

Descriptors: *Kelps, *Intertidal areas, *Plant physiology, *Drought resistance, Drying, Droughts, Algae, Metabolism, Habitats, Adaptation, Drought tolerance, Plant growth, Growth rates, Environmental effects, Moisture stress, Physiological ecology, Water balance, Water storage, Great Cumbrae Island, Scotland.

A laboratory study of fucoid algae collected from Great Cumbrae Island shores, Scotland, demonstrates that drought avoidance is not the primary means by which Pelvetia and Fucus spiralis adapt to upshore habitats. Fucoid algae normally appear in well-defined zonal sequences with Pelvetia canaliculata highest on shore, followed by Fucus sprialis, then a mixed Ascophyllum nodosum and F. vesiculosis zone and finally lowshore species, F. serratus. Four means of drought avoidance are examined: physical evaporation barrier, hygroscopic substances, low surface to mass ratio, and specialized thallus shape and growth hatits. Epidermis of upshore fucoids offers only slight water loss resistance. F. spiralis and Pelvetia loose 79.5 micro g water/sq mm/h. At water potentials of -395 to -150 bars, F. spiralis retains significantly more water per 100 g Dw than either Pelvetia or F. serratus; while under drier conditions, the three species have similar hygroscopic capacities. Pelvetia consistently has highest dry matter content and percent of water bound. In small plants from F. serratus to Pelvetia, surface to mass ratio decreases, however, this reverses in adult plants. Similar surface to mass ratio Pelvetia segments dry faster than Fucus blades. Pronounced dessication rate differences between stipes and blades is evident in each species. Pelvetia exceeds F. spiralis considerably in weight and branch overlap degree. F. spiralis and Pelvetia can reach very low water potentials (96%) loss, yet when resubmerged and cultured, all plants survive. (Danovich-Wisconsin)
W80-01979

A PRELIMINARY STUDY OF ALGAL TURF COMMUNITIES OF A SHALLOW CORAL REEF LAGOON USING AN ARTIFICIAL SUBSTRATUM,

Sydney Univ. (Australia). Dept. of Botany.
M. A. Borowitzka, A. W. D. Larkum, and L. J. Borowitzka.
Aquatic Botany, Vol 5, No 4, p 365-381, 1978. 5 Fig, 4 Tab, 33 Ref.

Descriptors: *Biological communities, *Coral, *Reefs, *Artificial substrates, *Great Barrier Reef(Australia), *Marine algae, Algae, Australia, Metabolism, Biomass, Standing crops, Equipment, Laboratory equipment, Population, Distribution, Colonization, Succession, Grazing, Productivity, Speciation, Benthic fauna.

Rapid glass slide colonization rates by algae and almost immediate algal recovery after intensive grazing (except by coralline algae) in a 1972-1974 study at One Tree Island lagoon, Great Barrier Reef, Australia, show that turf algae are the most important primary producers in reef ecosystems. Bacteria and diatoms colonized slides within 24 h; after three months, slides were covered by filamentous and encrusting algae such as Sphacelaria tribuloides Meneghini, Herposiphonia tenella, Tenarea sp, and some invertebrates such as Spirorbis sp. Early colonizers include coralline and blue-green algal species. Grazing occurs sufficiently often so that few coralline crusts survive near glass slide centers. Eventually, thicker crustose corallines such as Porolithon onkodes, from less grazed slide edges begin to overgrow slides; this provides substratum for Laurencia and Lophosiphonia species which do not grow directly on slides. Observed edges effects in algal distribution are caused by water movement around and over substrate and differential grazing pressure near edges compared with flat central areas. Algal species numbers and abundance increase with time. Green algae such as Cladophoropsis, Chlorodesmis, and Cladophora, and small Laurencia plants, occur mainly inside micro-atolls or at four m depths. In reticulate reef enclosed parts green and brown algae are absent; however, coralline and blue-green algae grow abundantly. Coralline, blue-green, and red algae such as Ceramium are observed in slides near two large coral masses in open sandy areas. (Danovich-Wisconsin)
W80-01980

THE CULTURE COLLECTIONS OF ALGAE AT THE UNIVERSITY OF TEXAS AT AUSTIN.

Texas Univ. at Austin. Dept. of Botany.
R. C. Staar.
Journal of Phycology, Vol 14, supplement, p 47-100, December 1978. 243 Ref. NSF DES76-81979.

Descriptors: *Algae, *Texas, *Cultures, *Classification, *Research facilities, *Research equipment, Universities, University of Texas, Austin, Microbiology, Plant growth, Systematics, Laboratory tests.

This paper alphabetically lists algal cultures, maintenance media, and special growth media availale from the University of Texas and Austin. Culture orders are accepted by letter, purchase order or telephone from all interested individuals and organizations. Each culture is $4.00 postpaid for academic and nonprofit institutions; $10.00 per culture postpaid for commercial organizations. The Culture Collection of Algae was formerly located at Indiana University, Bloomington an moved to the University of Texas during 1976-1977. The National Science Foundation supports the collection as a national research resource. Information such as the strain isolator, idenity with strains in other collections, and use in publications is included. The algal collection includes Acetabularia Lamouroux, Peridinium Ehrenberg em. Stein, and Zygnema C. Agardh. Maintenance media ranges from Allen's medium, to ES enrichment for seawater, to YT20 medium. Special growth media ranges from Anacystis nidulans (Synechococcus leopoliensis) to Volvox. (Danovich-Wisconsin)
W80-01981

MODIFICATION OF PHOSPHORUS RETENTION MODELS FOR USE WITH LAKES WITH LOW AREAL WATER LOADING,

McGill Univ., Montreal (Quebec). Dept. of Biology.
M. L. Ostrofsky.
Journal of the Fisheries Research Board of Canada, Vol 35, No 12, p 1532-1536, December 1978. 4 Fig, 2 Tab, 12 Ref.

Descriptors: *Phosphorus, *Equations, *Lakes, *Retention, *Mathematical models, Model studies, Time, Mathematical studies, Nutrients, Water quality, Water properties, Waste assimilative capacity, Canada, Runoff, Streams, Correlation analysis, Graphical analysis, Mathematics, Rainfall.

Normal equations calculating phosphorus (P) retention do not hold for low areal water load lakes; therefore, this model study examines 53 lakes in the Canadian Shield area during 1975-1976 to find new relationships between P retention and areal water load (q-s). Lake P retention is usually determined from its q-s, calculated as average annual discharge (in cu m from excess precipitation), divided by lake surface area (sq m). Mathematical relationships between P retention and q-s are hyperbolic, and therefore, extremely sensitive to small q-s changes, particularly when q-s is low. Canadian Shield lakes experience low rainfall (25 cm/yr) and high evapotranspiration, insuring low q-s values. Surface areas range from 3.8 to 3375 ha, and q-s varies from 0.3 to 180 m/yr. Mean P concentration of winter and summer precipitation were 18.7 and 271.8 micro g/l, respectively, indicating a 0.4 kg P/ha/yr aeolian contribution. Stream export ranged 0.36 to 7.05 kg P/sq km/yr. In many cases, predicted and observed P concentrations did not agree. When relative error is graphed as a q-s function, large errors occur in q-s values less than 10 m/yr and predicted P concentration is always underestimated in this low q-s range. With the original data, new relationships between q-s and P retention were determined; several functions, including simple exponential, multiple polynomial, and logarithmic, fit and data well and an infinite number of plausible solutions give equally satisfactory results over observed data ranges. (Danovich-Wisconsin)
W80-01982

PHYSICAL AND CHEMICAL LIMNOLOGY OF LAKE RINIHUE (VALDIVIA, CHILE),

Universidad Austral de Chile, Valdivia. Inst. of Zoologio.
H. Campos, J. Arenas, W. Steffen, and G. Aguero.
Archiv fur Hydrobiologie, Vol 84, No 4, p 405-429, December 1978. 17 Fig, 4 Tab, 21 Ref.

Descriptors: *Chile, *Lakes, *Chemical properties, *Physical properties, *Seasonal, *Lake Rinihue(Chile), Physiocochemical properties, Limnology, Stratification, Fjords, Color, Transparency, Temperature, Dissolved oxygen, Nitrates, Silica, Rainfall, Light.

This May 1975-1976 study of water property changes and trophical situations in Lake Rinihue, a warm, monomictic, oligotrophic lake, near Valdivia, Chile, shows marked seasonal changes from winter to spring. Variations are influenced by local climatic components such as wind speed and direction, rainfall, air temperature, and cloudiness. High winter winds produce strong waves, water overturn, and higher precipitations. Spring winds influence the warming periods, prevent thermal stratification by upper strata mixing, and maintain low spring thermal stability. Summer winds modify epillimnion thickness and temperatures 15 m down may reach 13 C. Maximum and minimum rainfall determine high and low effluent flow; the drainage area is 53.1 times larger than the lake area. Two seasonal vertical water temperature cycles were observed: a winter circulation warming up period begins in October and highly stable vertical columns produce summer stagnation in February. Chemical concentrations vary greatly winter to spring. During winter circulation periods, concentrations of conductivity, bicarbonate alkalinity, hardness, anions and cations, silica and oxygen are low. Only sulfate and nitrate show higher winter concentrations than in spring. Silica ranges 0.8 to 3.0 mg l in winter and increases notably to 8-12 mg l in spring and summer. Nitrate, fluctuating 5.75 micro g/l, is the only solute displaying marked seasonal stratification. In spring and summer, concentrations decrease in the surface, while they increased in deep layers. These two concentrations become one during winter circulation. (Danovich-Wisconsin)
W80-01983

PRIMARY PRODUCTIVITY OF A HYPERSALINE ANTARCTIC LAKE,

Victoria Ministry of Conservation, Melbourne (Australia).
P. J. Campbell.
Australia Journal of Marine and Freshwater Research, Vol 29, No 6, p 717-724, December 1978 2 Fig, 2 Tab, 18 Ref.

Descriptors: *Primary productivity, *Saline lakes, *Algae, *Antarctic, Lakes, Speciation, Biomass, Productivity, Light, Temperature, Saline water, Salt to tolerance, Plankton, Phytoplankton, Cold regions, Polar regions, Environmental effects, Physiological ecology.

Deep Lake, Antarctica, has very low productivity, 3.3 g C sq m h, compared with 9.8 mg C sq m h for Watts Lake, another Antarctic lake, making Deep Lake one of the least productive lakes recorded. Due to high salinity (270 g 1), Deep Lake remains ice-free throughout the year despite low ambient temperatures ranging from +10 to -16 C. Biota in the 0.58 sq km lake consists of two unidentified unicellular green algae species and several species of bacteria; however, invertebrates and herbivorous organisms are absent. Water samples and temperature measurements were taken January 1975 to January 1976, near the lake center where depths are 33.5 m. Twelve in-situ experiments were performed in Deep Lake. Significant primary production was recorded only once; a sample collected near the bottom after sediments were disturbed gave a value of 0.18 mg C cu m h. With all other experiments, the level of production was below the detection limit (0.15 mg C cu m h). A 3.3 g C sq m upper phytoplankton production limit in Deep Lake was calculated assuming a production zone from 0-15 m fo six months at a 0.1 mg C cu m h rate and 12 h day length. Speices diversity, population, and productivity are limited by nutrient deficiency, hypersalinity, low temperature, and annual light level extremes. (Danovich-Wisconsin)
W80-01984

ZOOPLANKTON DISTRIBUTION IN RELATION TO THE HYDROLOGY OF THE DERWENT RIVER ESTUARY,

Tasmania Univ., Hobart (Australia). Dept. of Zoology.
N. Taw, and D. A. Ritz.
Australian Journal of Marine and Freshwater Research, Vol 29, No 6, p 763-775, December 1978. 5 Fig, 14 Ref.

Descriptors: *Estuaries, *Zooplankton, *Ecological distribution, *Copepods, Tasmania, Australia, Plankton, Distribution, Bioindicators, Estuarine environment, Rivers, Aquatic animals, Salinity, Saline water-freshwater interfaces, Tides, Tidal waters, Tidal streams, Tidal effects, Habitats.

A 1973-1974 study of the Derwent River in southeast Tasmania, Australia showed correlation between hydrologically established zones and zooplankton distribution. The most significant river region both hydrologically and in zooplankton distribution terms is the tidal zone. Both major estuarine species and marine species are found in this zone. Two cruises, one in October 1973 and the other in April 1974, were selected to cover high and low freshwater flow periods at the lower 50 km of the Derwent River. Four estuarine zones are classified according to hydrological characters and bottom deposits: marine, tidal, gradient, and freshwater. Gladioferens pectinatus is the most abundant estuarine species ranging up to 5,000 adults cu m and distributed throughout most of the river Sulcanus conflictus is abundant in the tidal and gradient zones ranging in number up to 800 copepodites cu m. This species is limited to salinities of 4-23%. Cyclopoid Mesocyclops leuckarti and ca-

lanoid Boeckella triarticulata are confined to freshwater. In the marine zone, two calanoid copepod species, Paracalanus parvus and Acartia tranteri dominate zooplankton populations. During October the number of adults increases downstream and reaches maximum in marine areas. Copepodites prefer the tidal region. In April, adults dominate the population in all areas. Both adults and copepodites concentrate in marine areas. Apart from major flood periods, only minor zonation shifts occur in the Derwent estuarine system. (Danovich-Wisconsin)
W80-01985

DENITRIFICATION IN NATURAL WATERS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
P. L. Brezonik.
Progress in Water Technology, Vol 8, No 4-5, p 373-392, 1977. 1 Fig, 2 Tab, 111 Ref.

Descriptors: *Denitrification, *Biochemistry, *Sediments, *Natural streams, *Nitrate, *Reviews, Nitrogen, Nitrogen cycle, Anaerobic conditions, Aquatic productivity, Nitrogen gases, Ammonia, Eutrophication, Microbiology, Sediment-water interfaces, Oceans, Lakes, Lake Mendota(WI).

A general review of denitrification shows it is an important sink for nitrogen in the biosphere but that quantification of its role in specific water bodies is elusive. Rates of denitrification in anoxic systems are probably limited more by availability of oxidizable substrates than by any other environmental factor. Information is needed not only on nitrogen sources but also on dissipative reactions or nitrogen sinks. The role of oxygen in denitrification is controversial, however, denitrification is presemed to require anoxic conditions. Denitrification ceases upon exposure of microorganisms to oxygen only after a period of adjustment. Given an anoxic environment and the presence of nitrate, the primary factor affecting the denitrification rate is the concentration of biodegradable organic matter. Since the product of denitrification is a gas, N2, precise determinations of denitrification rates are difficult. Denitrification rates vary in sediments 5-60 mgn/ sq m - hr in cores from English rivers and is 8.3 g N/ sq m - yr in a Danish lake. New techniques are still being sought for measurements of lake denitrification. The current techniques strongly depend on accuracy of the nitrogen budget and the groundwater contribution of nitrates. Although in-situ determinations of oceanic denitrification rates are difficult, values range from 1 x 10 to the 13th power g/yr to 2.3 x 10 to the 14th power g/yr nitrogen loss via denitrification in eastern tropical north Pacific. Denitrification rates are important in determining oceanic global nitrogen balances, nitrogen budgets for fresh water bodies, and nitrate fertilizer losses to the soil. (Danovich-Wisconsin)
W80-01989

BIOLOGICAL AVAILABILITY OF LOW VERSUS HIGH MOLECULAR WEIGHT REACTIVE PHOSPHORUS,
North Carolina Univ., Morehead City. Inst. of Marine Sciences.
H. W. Paerl, and M. T. Downes.
Journal of the Fisheries Research Board of Canada, Vol 35, No 12, p 1639-1643, December 1978. 2 Fig, 3 Tab, 13 Ref.

Descriptors: *Growth rates, *Chorella, *Phosphorus, *Bioassay, *Cycling nutrients, Phosphorus compounds, Algae, Phosphates, Orthophosphate, New Zealand, Lakes, Nutrients, Nutrient removal, Nutrient requirements, Turnovers, Time, Kinetics.

Chlorella preferentially utilize free orthophosphate (PO4) over reactive high molecular weight phosphorus (RHMWP) in two New Zealand Lakes, but given enough time in PO4 absence, RHMWP is utilized as well. This summer study compares short-term PO4 turnover between lakes showing high and low proportions of reactive phosphorus (P) present as PO4. Long-term biological availability of both RHMWP and PO4 is also tested by P-starved Chlorella culture inoculations. In Lake Tutaeinanga, New Zealand, 0.5 mg/cu m is PO4 out of 41 mg/cu m total reactive P; in Lake Okaro 44 mg/cu m is PO4 out of 50 mg/cu m total reactive P. No detectable PO4 turnover is found in Okaro, whereas Tutaeinanga shows a 3.7 h turnover time. In addition to PO4 pool size, turnover rates depend on temperature, light, and microbial biomass. Biomass is 1150 mg C/cu m for Okaro and 1075 mg C/cu m for Titaeinanga. In July, reactive P pool analysis following Sephadex fractionation reveals 80% of reactive P in Okaro is free PO4, while in Tutaeinange 20% of reactive P is free PO4. Bioassay parameters indicate that PO4 has more immediate Chlorella growth stimulatory effect than equivalent RHMWP amounts. In short-term incubations, although RHMWP is less available, this faction eventually is utilized to the same extent as PO4. This explains why turnover times in Tutaeinanga are several hours instead of a few minutes. (Danovich-Wisconsin)
W80-01990

MULTIPLE INTERACTION OF FACTORS IN THE DISTRIBUTION OF SOME HAWAIIAN GELIDIALES (RHODOPHYTA),
Hawaii Univ., Honolulu. Dept. of Botany.
B. Santelices.
Pacific Science, Vol 32, No 2, p 119-147, 1978. 26 Fig, 2 Tab, 61 Ref.

Descriptors: *Rhodophyta, *Hawaii, *Distribution, *Reefs, *Plant physiology, Algae, Biomass, Light intensity, Water circulation, Growth rates, Nutrients, Productivity, Limiting factors, Distribution patterns, Resistance, Intertidal area, Movement, Water temperature, Salinity, Ecological distribution.

Field and experimental work July 1973 to July 1974 indicate that specific differences in tolerance ranges and optima levels of light intensity, water movement, and their combined effects most probably cause observed gelidiales distribution off the island of Oahu, Hawaii. Temperature and salinity produce significant effects only at experimental values exceeding filed observed values. Pterocladia caerulescens is restricted to nearshore reef edges, P. capillacea occurs in seaward reef margins, and Gelidiella acerosa extends across flat areas overlapping the two other species. Average reef biomass is 1.75 gDwt/sq m for P. caerulescens, 1.47 g Dwt/ sq m for G. Acerosa, and 0.71 gDwt/sq m for P. capillacea. Pterocladia thallus size and horizontal distribution and all three species' biomass have seasonal cycles with maxima in December and minima in May. The three species have low light saturation values and their thalli appear pale or bleached when exposed to full sunlight. Full sunlight is tolerated by G. acerosa and P. caerulescens, but is detrimental to P. capillacea. Highest water movement values are optimal for P. capillacea, but limiting for P. caerulescens and G. acerosa. Experimental results show close relationships between water movement, diffusion and algal growth. High water movement, high water renewal rate, or nutrient addition allows all three species, within their individual limits, to utilize more efficiently higher light and temperature levels, as shown by absence of bleaching and faster growth. (Danovich-Wisconsin)
W80-01991

MATHEMATICAL MODELLING OF EUTROPHIED COASTAL AREAS,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
K. I. Dahl-Madsen.
Progress in Water Technology, Vol 10, No 5-6, p 217-235 1978. 15 Fig, 27 Ref.

Descriptors: *Mathematical models, *Eutrophication, *Coasts, *Equations, Waste water, Denmark, Hydrodynamics, Statistics, Cytological studies, Water quality, dispersion, Nutrient transport, Zooplankton, Phytoplankton, Detritus, Nitrogen, Cycling nutrients, primary production, Sediments, Macrophytes, Phosphorus.

Since some Danish regulations allow waste water discharges into shallow coastal areas, mathematical models of the combined hydraulic and biological/ chemical processes in the discharge area have been developed. Variables used in the model equations are significant in describing the eutrophic water system. However, the biological and chemical variables must not be over-emphasized; the physical transport processes must also be included. Most models focus on phytoplankton growth including intracellular nutrients and emphasize obtaining a firm hydraulic basis. A description of chlorophyss-a as a state variable and an abundance of fish in the area should be included. In shallow nearshore marine areas, macrophyutes may contribute considerably to total primary production and should also be incorporated into the model. Nutrient exchange rates between water and sediment are important. The combined transport dispersion and reaction model was favorably tested and used in calculating the consequences of waste water plans. Models for the years 1970-1977 were compared for 15 marine coastal water system. Two guidelines were suggested for further work; keep models general and communicate output to decision makers. (Danovich-Wisconsin)
W80-01993

WATER CONDITIONS IN THE STOCKHOLM ARCHIPELAGO AFTER THE INTRODUCTION OF BIOLOGICAL AND CHEMICAL PURIFICATION OF WASTE WATER,
Stockholm Water and Sewerage Works (Sweden).
M. Cronholm, and K. Abennerstedt.
Progress in Water Technology, Vol 10, No 5-6, p 273-295 1978. 17 Fig, 15 Ref.

Descriptors: *Stockholm, Sweden, *Waste water treatment, *Water pollution control, *Pollution abatement, *Sewage disposal, Oxygen, Islands, Ammonia, Water pollution, Lake Malaren, Sweden, Nitrogen, Phosphorus, Anaerobic conditions, dentrification, Sediments, Nutrient removal.

Since biological and chemical purification of all waste water released into Stockholm's inner archipelago began in 1970, formation of hydrogen sulfide in deep waters, biochemical oxygen consumption, and phosphorus pollution all decreased from 980 tons to 98 tons by 1976. The Stockholm archipelago, a group of 24,000 islands, has long been used as the Stockholm waste water recipient. Water quality has been monitored since the late 19th century, noting an oxygen deficiency, hydrogen sulfide in inner areas, and surface algal turbidity. The six waste water treatment plants presently serve 860,000 people and some of the waste water is mixed with deep archipelago water before it is discharged. After purification began many poitive effects were seen: In 1974-1976 very little phosphorus was retained in the sediments, however, there was much nitrogen loss, primarily due to deitrification. While the total nitrogen-total phosphorus waste water load ratio was 30:1 the recipient surface water ration was 15:1. The chlorphyll content was lower in 1974-1976 than in 1970-1972 and a corresponding increase of 0.5-lm was shown in transparency measurements. The biochemical waste water oxygen consumptions increased from 1000 tons/yr in the early 20th century to 10,000 1900-1950. A considerable decrease between 1969-1972 occurred as a result of the purification. (Danovich-Wisconsin)
W80-01994

THE SIGNIFICANCE OF PLANT NUTRIENT YIELDS IN RUNOFF FROM A MIXED LAND USE WATERSHED,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
T. J. Grizzard, C. W. Randall, R. C. Hoehn, and K. G. Saunders.
Progress in Water Technology, Vol 10, No 5-6, p 577-596, 1978. 5 Fig, 6 Tab, 12 Ref.

Descriptors: *Land use, *Storm water, *Runoff, *Nutrient loading, *Occoquan Reservoir, *Water pollution sources, Watershed, Nutrients, Rural areas, Equations, Storm runoff, Urban runoff, Virginia, Washington(DC), Potomac River, Water pollution control, Mathematical models, Nitrogen, Phosphorus.

Runoff accounts for the greatest nitrogen and phosphorus loadings to Occoquan Reservoir, located in Virginia at the mouth of a major tributary

to the Potomac estuary. Point sources alone produced 14.8% of total reservoir nitrogen and 11.7% of total reservoir phosphorus during periods of low runoff indicating the continuing importance of point source pollution. The Occoquan Reservoir, used as a water supply for 600,000 people and draining a 148,000 ha watershed, experienced cultural eutrophication in the 1960's displaying fish kills, nuisance algal blooms, and hypolimnetic deoxygenation. The reservoir serves two subbasins: one urban and one rural. During fiscal year 1975-1976, flow-weighted composit samples were obtained from seven automatic pumping sampler stations. Automated analysis systems determined levels of nitrogen and phosphorus and a summary of these nutrient loadings were obtaned from log-linear regression analyses of the data. The rate of nutrient production on an individual-event basis was a function of land use with urban lands generating significantly more nitrogen and phosphorus per ha than rural lands. The urban lands produced 2.3% more nitrogen and 2.0% more phosphorus annually on a unit area basis than rural lands. On an absolute basis these ratios were 1.3 and 1.1 respectively. U.S. attention has mainly focused on point source discharges of industrial and domestic wastewaters and the availability of federal pollution abatement funds has been depleted. However, recent studies indicate non-point pollution sources may be highly significant in determining receiving water quality. (Danovich-Wisconsin)
W80-01995

THE DISTRIBUTION, ABUNDANCE, COMMUNITY STRUCTURE, AND PRIMARY PRODUCTIVITY OF MACROORGANISMS FROM TWO CENTRAL CALIFORNIA ROCKY INTERTIDAL HABITATS,
California State Univ., Fullerton. Dept. of Biological Science.
R. R. Seapy, and M. M. Littler.
Pacific Science, Vol 32, No 3, p 293-314, 1978. 9 Fig, 5 Tab, 19 Ref.

Descriptors: *Intertidal areas, *Habitats, *Rocks, *Biological communities, *Primary productivity, California, Benthos, Tidal effects, Tides, Speciation, Distribution, Standing crops, Distribution patterns, Waves(water), Cyanophyta, Mussels, Invertebrates, Sessile algae, Coasts, Systematics.

Standing stocks of algae, community structure, and primary productivity of a wave-washed, steeply sloping sea stack was contrasted with nearby sheltered, gently sloping boulder beach at Cayucos Point, central California, from 1973 to 1976, quantitatively documenting marked biological differences between these two prominent rocky intertidal habitats. The boulder beach is protected by a large rock promontory, while the sea stack is inundated by large breakers during high tides. Mahor site differences are vabe shearing forces and habitat structure. Macroinvertebrates such as mussels, barnacles, and limpets dominate upper and middle intertidal zones with high shearing forces. Sea stack animal dominance lowers overall community productivity, 116.5 mg C/sq m/h, and results in marked animal/plant break between upper and lower shore areas. Crevices, angled substrates, and rivulets at boulder beach result in less pronounced vertical zonation patterns and macrophyte predominance; community productivity is 169.7 mg C/sq m/h. Blue-green algae and Endocladia muricata are the most abundant macrophytes at both sites. Sessile macrionvertebrates such as Mytilus californianus, Chthamalus fissus, and Balanus glandula dominate the sea stack. Sesslie Anthopleura elegantissima, C. fissus, and c. dalli, and mobile macroinvertebrate, Tegula funebralis, are the most numerous species at boulder beach. Greater taxa numbers and higher species richness values occur at boulder beach; however, evenness index and Shannon's index indicate higher diversity on the sea stack. (Danovich-Wisconsin)
W80-01996

THE THEORY OF CONTROL OF MICROBIAL GROWTH KINETICS BY LIMITING NUTRIENT CONCENTRATIONS,
Alaska Univ., Fairbanks. Inst. of Marine Sience.
D. K. Button.
Deep-Sea Research, Vol 25, No 12, p 1163-1177, 1978. 5 Fig, 1 Tab, 49 Ref.

Descriptors: *Theoretical analysis, *Nutrients, *Growth rate, *Aquatic microorganisms, *Kinetics, Model studies, Algae, Bacteria, Sea water, Limiting nutrients, Nutrient transport, Nutrient flax, Phosphates, Carbon, Glucose, Equations, Marine microorganisms, Cycling nutrients.

Formulations of growth kinetic expressions relating nutrient concentration to nutrient transport and to nutrient limited growth rate are derived in an attempt to develop a theoretical foundation for marine microorganisms-nutrients relationships. Examples show that nutrient transport restricts maximal growth rate only in certain instances. It is demonstrated that normal vairations in cell yield from substrate consumed at various growth rates can affect growth kinetic curves, an effect unrelated to saturation phenomena. Nutrient uptake and growth rate are plotted against nutrient concentration for a number of siturations, and kinetic constants for these curves are discussed. Thresholds, Michael's constants and affinities are examined; the latter, more closely defined here than in previous studies, is suggested as one of the more useful constants for describing kinetics of aquatic microbial processes. Also considered are the limiting nutrient concept, the cell quota concept, transient state versus steady state conditions, and population measurements. Understanding of growth kinetics in the marine environment is currently limited by insufficient knowledge of active transport mechanisms and inability to discriminate among small concentrations of biochemicals. (Luedtke -Wisconsin)
W80-01998

5D. Waste Treatment Processes

STATISTICAL ANALYSIS OF STREAM EVENTS AS APPLIED TO CONTROLLED RELEASE OF LAGOON EFFLUENTS,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
V. L. Zitta, and B. A. Mowry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116288, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Report, October 1979. 50 p, 20 Fig, 1 Tab, 8 Ref. OWRT A-126-MISS (1), 14-34-0001-9026.

Descriptors: *Waste water disposal, *Water pollution control, *Controlled release, Streamflow, Hydrographs, Statistics, Waste water, Discharge, Lagoons, Effluents.

High construction and operating costs of alternative waste treatment processes dictate the retention of lagoons as a waste management alternative for small towns with less than 2 mgd flow and for towns located on 'water quality limited' stream segments. Retention of lagoons is possible provided secondary treatment standards and stream quality criteria are met. The first criteria is met by lagoon design and the second can be met by discharge of the effluent during stream events. An event is defined as a maximum on the hydrograph irrespective of magnitude or time of occurrence. This research is an attempt to establish the methodology applicable to the hydrologic design of waste discharge into natural streams with characteristic rise and fall of a stochastic nature. The lognormal distribution function was deemed adequate by the Kolmogorov-Smirnov test to describe the histograms of maximum annual spans between stream events. Based on the span between events, the time of storage during low flow periods can be specified with a given cumulative probability or return period. Based on this return period the size of a storage system can be determined for given volumetric inflow rates.
W80-01605

INDUSTRIAL WASTEWATER TREATMENT FOR INDUSTRIAL PARKS IN TAIWAN,
Taiwan Industrial Development Bureau, Taipei.
S. Chen, C. P. Chen, and T. Y. Lee.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited b E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc. in USA). p 71-76, 1978. 1 Tab.

Descriptors: *Waste water treatment, *Industrial parks, *Taiwan(China), Water quality, Water quantity, Treatment facilities, Operation and maintenance, Planning, Design, Standards, Waste discharge, Fee rating.

Past experiences indicate that the quantity and quality of wastewater actually treated differ greatly from those assumed in the design of industrial wastewater treatment plants. These call for a high flexibility of the treatment system and the staged construction of the plant based on indexes obtained from pilot plant studies. In the Republic of China, the training of operators is being speeded up to ensure proper operation and maintenance of the plant. Various studies seeking a practical and rational fee-rating system are also being undertaken. (Bell-Graf--Cornell)
W80-01614

REVIEW OF SELECTED INDUSTRIAL WASTE TREATMENT PLANTS IN SINGAPORE,
L. Menon.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, V.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 261-277, 1978. 3 Fig, 4 Tab.

Descriptors: *Industrial wastes, *Treatment facilities, *Waste treatment, *Standards, *Watercources, *Singapore(Malaya), Sludge, Effluents, Seweres, Textiles, Chicken processing, Dyeing, Bleaching, Governments.

To illustrate the expertise available and experience gained in this region, the paper reviews three selected industrial waste treatment plants in Singapore. Industrial waste problems, methods of treatment, operational experiences and final effluent of the selected textile, chicken and food processing plants to meet Singapore Government legislated sewer and watercourse standards and tariff schemes are examined. Important points in the investigation, design and operation of industrial waste treatment plants are summarized. The essential first step is that the factory should be encouraged to practice good housekeeping, water-saving and process control to minimize the cost of treatment of the wastes. (Bell-Graf--Cornell)
W80-01635

PROTEIN PRODUCTION FROM CELLULOSE WASTES,
Queensland Univ., Brisbane (Australia). Central Animal Breeding House
D. P. Henry, and P. F. Greenfield.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 279-286, 1978. 2 Fig, 4 Tab, 9 Ref.

Descriptors: *Waste water treatment, *Protein production, *Cellulose, *Wastes, Streams, Feed lots, Digestion, Volatile fatty acids, Anaerobic fermentation, Yeast growth, Nutritive value, Economic potential.

A description is given of a process which treats cellulose-rich waste streams such as those from intensive animal feedlots by converting the waste materials to volatile fatty acids under anaerobic conditions and then producing yeast aerobically using the fatty acids as principal substrates. The process has potential in treating concentrated wastes and in converting other cellulosic materials such as grasses to protein. (Bell-Graf--Cornell)

W80-01636

ENERGY AND USEFUL BY-PRODUCT RECOVERY FROM ANIMAL WASTES,
Food and Agriculture Organization of the United Nations, Malaya (Singapore).
E. P. Taiganides.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B. N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 315-323, 1978. 4 Fig, 4 Tab, 8 Ref.

Descriptors: *Energy, *Byproducts, *Recovery, *Animal wastes(Wildlife), *Technology, *Costs, Fertilizers, Anaerobic digestion, Gases, Plant nutrients, Pryolysis, Bihugas plants.

Animal wastes are 'resources out of place.' They contain sufficient quantities of nitrogen, phosphorus, potassium and micronutrients which serve as well-balanced fertilizers for plant growth and also as soil conditioners. Plant nutrients are in readily available forms and may be recovered in soil-plant systems within 3 years. Animal wastes may be converted to feed components through concentration by dehydration, by fermentation as silage, and/or by fungi/yeast, and by concentration into cellular bacterial or algal protein. Animal wastes contain energy which may be recovered as gas energy by anaerobic digestion or as solid/liquid energy by pyrolysis. Their energy content can also be reclaimed when using manures as animal and/or plant feed. This paper delineates the levels of technologies and costs for the utilization of animal wastes as plant nutrients and for energy recovery. (Bell-Graf--Cornell)
W80-01639

WASTE TREATMENT AND METHANE PRODUCTION BY A PLASTIC-MEDIA ANAEROBIC FILTER,
Technische Hochschule, Darmstadt (Germany, F.R.). Inst. for Wasserversorgung, Abwasserbeseitigung und Raumplanung.
K. Suwarnarat, and W. Weyrauch.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 325-336, 1978. 5 Fig, 3 Tab, 9 Ref.

Descriptors: *Waste treatment, *Methane, *Anaerobic filter, *Evaluation, Biochemical oxygen demand, Experiments, Influent, Loadings, Synthetic waste preparation, Plastic contact media.

The performance of anaerobic filter using plastic contact media was evaluated using synthetic media with biochemical oxygen demand of 3,000 mg/l. The process could remove 49 to 86% of the influent BOD at loadings of 5.7 and 10 kg of BOD/cu m-d respectively. In terms of the reactor volume requirements, the anaerobic process has a higher efficiency. (Bell-Graf--Cornell)
W80-01640

BIODEGRADATION OF PALM OIL SLUDGE AND ITS WASTE RECOVERY AS AN ENERGY SOURCE FOR ANIMALS AND SOIL AMENDMENT,
Universiti Sains Malaysia, Penang. Pusat Pengajian Sains Kajihayat.
P. M. Sivalingam.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 337-349, 1978. 6 Fig, 6 Tab, 11 Ref.

Descriptors: *Biodegradation, *Energy, *Sludge, *Palm oil, *Waste recovery, Animals, Soil amendment, Canal system, Industries, Malaysia, Treatment effects, Fermentation, Fish feed, Feasibility, Experiments, Biochenmical oxygen demand.

Extensive investigations on the efficiency of the currently practiced biodegradational canal system method of treating palm oil mill sludge have indicated that this mode of waste treatment is quite effective in lowering the BOD load. As such, an alternative means of palm oil sludge treatment is discussed. The utilization of plam oil sludge as a soil amendment and fish feed has also been investigated. Further, the feasibility of culturing a strain of Chlorella sp. isolated from the irrigational biodegradational canal system in fermented palm oil sludge supernatant and original sludge as an energy source for both human and fish consumption is also discussed. Experimental results indicate that the currently practiced irigational biodegradational canal system of treating palm oil sludge is practically inefficient, at least at the Batu Kawan Palm Oil Estate in Malaysia, and as such the polluting effect can be eliminated by the alternative fermentation processes suggested by Webb et al. (1975). With proper amendments, the sludge solids can be utilized as organic soil amendments and also as feed to carps. (Bell-Graf--Cornell)
W80-01641

MARICULTURE--BIOLOGICAL TREATMENT INDUSTRY,
McGill Univ., Montreal, (Quebec). Dept. of Chemical Engineering.
B. Volesky, and P. Tsantrizos.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 351-363, 1978. 4 Fig, 2 Tab, 20 Ref.

Descriptors: *Waste water treatment, *Biological treatment, *Algae, *Economic feasibility, *Mariculture, Industries, Nutrient removal, Biochemical oxygen demand, Tertiary treatment, Experiments, Animal feed, Ecosystems, Purification, Ponds, Influent, Costs, Sewage, Effluents.

Gradual growth of industry in developing countries leads to the discharge of increasing quantities of polluted or partially polluted waters. In favorable climates, the organic and inorganic content of wastewaters can be converted in marine-aquaculture systems into a needed commodity such as fish, lobster and oyster crops. A seaweed system alone is capable of nitrogen removal in an area of 60 acres with annual production of 16,300 tons net weight of seaweeds. The mariculture system can utilize local manpower and skills and simultaneously reduce the waste BOD loadings and achieve nutrient removals, enabling the exceedence of requirements for tertiary treatment contamination levels. Experimental investigations are discussed which have been carried out in several centers around the world on algal and mariculture systems. Animal feed materials recovered from algal operations and products of the controlled ecological systems are considered. Feasibility and econoomics of the controlled aqueous ecosystem for purification of wastewaters are briefly analyzed. (Bell-Graf--Cornell)
W80-01642

ANAEROBIC DIGESTION--OPTIMIZATION OF ENERGY SOURCE FROM WASTES,
McGill Univ., Montreal (Quebec). Dept. of Chemical Engineering.
B. Volesky.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA) p 365-372, 1978. 3 Fig, 1 Ref.

Descriptors: *Anaerobic digestion, *Waste water treatment, *Waste water disposal, *Energy source, *Developing countries, Biological treatment, Wastes, Biochemistry, Microbiology, Kinetics, Digesters, Methane yields, Technology, Optimization, Costs.

Anaerobic digestion, a traditional biological process for waste disposal, is receiving new and intense attention due to its relative simplicity and a potential to produce combustible gases. The attractiveness of anaerbic digestion for treatment of high-strength wastes in developing countries is associated with its flexible scale and low demands for more sophisticated technology. The system can be used locally as an alternative source of fuel energy for cooking, heating and driving engines. The successful use of anaerobic digestion technology for purification of household and farming wastes as well as high strength wastes originating from industrial operations is the key to efficient fuel gas mixture production which would help to alleviate the energy crisis. Description of the process is presented with evaluation of efficiences and operating parameters. Biochemistry, microbiology and kinetics of this complex microbial process are mentioned, leading to better understanding of its function which should result in the design of new types of reactors, enabling optimization of some key operating parameters. Further trends and areas are identified where development is required by interdisciplinary professions. (Bell-Graf--Cornell)
W80-01643

TECHNOLOGY TRANSFER FROM DEVELOPED TO DEVELOPING COUNTRIES IN THE AREA OF COMMUNITY WASTEWATER MANAGEMENT,
ADI Ltd., Fredericton, (New Brunswick).
T. Viraraghavan, and V. Raman.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B. N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 375-379, 1978. 2 Ref.

Descriptors: *Municipal water, *Waste water treatment, *Technology, *Developing countries, Waste water(Pollution), Management, Developed countries.

The transfer of technology from developing countries should not conflict with locally appropriate technology. The areas in which technology would be desirable and realistic are discussed. An international research center in environmental engineering for developing countries which would act as a focal point in technology transfer is proposed for an orderly and effective transfer of technology. (Bell-Graf--Cornell)
W80-01644

SEWAGE TREATMENT WORKS FOR SMALL COMMUNITIES--A NEED FOR CAREFUL DESIGN AND OPERATION,
National Inst. for Water Research, Pretoria (South Africa).
R. J. L. C. Drews, and J. H. Denysschen.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N. C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 381-397, 1978. 7 Fig, 1 Tab, 9 Ref.

Descriptors: *Sewage treatment, *Treatment facilities, *Design, *Operation and maintenance, Improvement, Stabilization, Ponds, Biological treatment, Purification plants, Biological filter plants, Activated sludge plants, South Africa.

An account is given of design faults, operational shortcoming and malfunctioning of units of small sewage works and the measure suggested for the improvement of plant performance. The observations made in practice pertain mainly to facultative (stabilization) pond systems, conventional biological filter plants and to extended aeration type activated sludge plants; they are meant to stimulate critical regular inspection of purification plants, which should lead to prompt application of practical corrective measures. Emphasis is placed on the need for properly trained, interested and motivated operators even for the smallest treatment works. (Bell-Graf--Cornell)
W80-01645

CASE STUDY OF EXISTING WASTEWATER FACILITIES OF SURAT--AN INDIAN TOWN,
S. V. Regional Coll. of Engineering and Technology, Surat (India). Dept. of Civil Engineering.
G. Ramprasad.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA) p 407-413, 1978. 4 Fig, 3 Tab.

Descriptors: *Waste water(Pollution), *Data collections, *Surat(India), Waste water disposal, Waste water treatment, Collection, Developing countries, Management, Daily, Characteristics, Quantity, Improvement.

Wastewater facilities of collection, treatment, and disposal in Surat, India were designed in 1946 and completed in 1957 for a prospective population of 0.3 million in 1976. Today the total population in the Municipal limits of Surat is about 0.6 million, and in the sewered area it is about 0.45 million. There are some places in the sewered ara of Surat which stink, including the wastewater treatment site. There are problems of over-flowing manholes, and waterlogging during the rainy season. This paper presents compiled data on the reasons for deficiencies in existing wastewater facilities and suggests methods to improve some of them. (Bell-Graf--Cornell)
W80-01647

AN IMMEDIATE MEANS OF URBAN WATER POLLUTION CONTROL IN DEVELOPING COUNTRIES,
Technische Hochschule, Darmstadt (Germany, F. R.). Inst. fuer Wasserversorgung, Abwasserbesitigung und Raumplanung.
K. Suwarnarat.
In: Water Pollution in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani & N. C. Thanh. Asian Institure of Technology, Bangkok, Thailand (Pergamon Press in USA), p 421-433, 1978. 9 Fig, 2 Tab, 11 Ref.

Descriptors: *Waste water treatment, *Treatment facilities, *Developing countries, Capital costs, Investment, Water pollution control, Urban development.

Rapid urbanization in developing countries has caused water pollution problems with which existing waste water treatment methods cannot adequately cope. This paper discusses the advantages and disadvantages of the on-site treatment system, and proposes its immediate application in developing countries to alleviate and combat urban water pollution. (Bell-Graf--Cornell)
W80-01649

REMOVAL OF MERCURY IN INDUSTRIAL WASTEWATER APPLICATION OF THIOUREA TYPE CHELATE RESIN,
Yokohama National Univ. (Japan). School of Engineering.
Y. Kobayashi, and M. Sugai.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 437-457, 1978. 14 Fig, 7 Tab, 15 REf.

Descriptors: *Industrial wastes, *Waste water treatment, *Mercury removal, *Chelating resin, *Experiments, Chemical properties, Effects, Adsorption, Anions, Oxidizing agent, Metallic ions, Heavy metals, Washings.

The problem of mercury removal from waste water has not been effectively solved by various known treatment methods. Studies were carried out on the application of a thiourea-type chelate resin as an alternative method; results obtained in the treatment of waste water containing mercury showed that the chelating resin method is superior in mercury removal from wastewater. (Bell-Graf--Cornell)
W80-01650

POLLUTION CONTROL THROUGH RECOVERY FROM WASTES AND EFFLUENT TREATMENT IN SYNTHETIC RESIN PROCESSING INDUSTRY,
Beck and Co. Ltd., Pimpri (India).
M. V. Vaidya.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology Bangkok, Thailand (Pergamon Press in USA), p 459-468, 1978. 4 Fig, 1 Tab, 2 Ref.

Descriptors: *Water pollution control, *Waste water treatment, *Treatment facilities, *Effluents, *Waste recovery, *Synthetic resin processing, *Waste salt filter cake, Industries, Industrial wastes, India, Developing countries, Evaluation, Low-cost alternatives, Irrigation, Lagooning.

The recovery of resin from polyester and epoxy resin production involving the use of locally available materials and technology in India as developed by Dr. Beck and Company is briefly reviewed and discussed. Treatment of the wastewater after resin recovery was evaluated using various low-cost alternatives such as irrigation and lagooning. (Bell-Graf--Cornell)
W80-01651

TREATMENT OF EFFLUENTS FROM TEXTILE FIBER PROCESSING INDUSTRIES,
Degremont S.A., Rueil-Malmaison (France).
J. M. Rovel.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 493-502, 1978. 1 Fig, 5 Tab.

Descriptors: *Waste water treatment, *Biological treatment, *Treatment facilities, *Efficiencies, *Textile processing, Pollutants, Effluents, Industries, Activated carbon, Treatment efficiency, Physico-chemical treatments, Purification processes, Tertiary treatment.

Despite the great variety of pollutants in the effluents of textile processing, the biological purification treatment by activated sludge remains the only process ensuring high efficiencies at acceptable costs, provided this treatment is adapted to the type of effluent to be treated. This is supported by plants already installed and in particular by the Barbry Cambron treatment unit described herein. To make the best of circumstances, tertiary treatments are available to improve the elimination of the color and residual COD. In this case, an economic study is necessary to determine whether or not granular activated carbon or oxidation by ozone will be applied. Finally, if emphasis is to be put upon water saving through recirculation, the use of submerged biological filtering beds could permit an interesting recirculation of the less polluted rinse water, which often represents 20 to 50% of the water consumed at the works. (Bell-Graf--Cornell)
W80-01653

PALM OIL WASTE TREATMENT BY AEROBIC PROCESS,
Singapore Univ., Dept. of Civil Engineering.
K. K. Chin.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 505-511, 1978. 2 Fig, 3 Tab, 5 Equ, 13 Ref.

Descriptors: *Waste water treatment, *Aerobic process, *Feasibility, *Palm oil, *Processing waste, Evaluation, Biochemical oxygen demand, Equations, Experiments, Color, Settling characteristics, Steady state, Biokinetic coefficients, COD.

The objective of this study was to determine the technical feasibility of treating crude palm oil processing waste by the aerobic treatment process. Biokinetic coefficients were evaluated and found to be not significantly different from pulp and paper, and other organic wastes of high BOD strength. The settling characteristics of the treated waste were significantly improved compared with its raw state. Overall, the aerobic systems studied proved to be effective in the removal of BOD and COD but not effective in color removal. (Bell-Graf--Cornell)
W80-01654

CASE STUDIES OF AGRO-INDUSTRIAL WASTEWATER POLLUTION CONTROL IN THAILAND,
Siam Technology Co. Ltd., Bangkok (Thailand).
R. J. Frankel, H. F. Ludwig, and C. Tongkasame.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 513-524, 1978. 1 Fig, 4 Ref.

Descriptors: *Water pollution control, *Industrial wastes, *Agro-industries, *Waste discharge, Waste water treatment, Treatment facilities, Factories, Standards, Food processing, Sugar cane, Pineapple canning, Fish processing, Receiving streams.

Thailand, as a major producer of agro-industrial exports, is experiencing increasing pollution problems from the discharge of food processing wastewaters into receiving streams. Licensing of new plants is now contingent upon prior government approval of proposed water systems. Unfortunately adoption of excessively strict standards has led to unenforceable situations. Case studies of three important agro-industries in Thailand are represented: cane sugar, pineapple canning and fish processing industries. This paper reviews typical waste discharges from these factories, the initial waste water treatment design, modifications which occurred as waste generation was reduced due to process change, and renewed interest in recirculation and reuse of waste by-products. (Bell-Graf--Cornell)
W80-01655

TREATMENT STUDIES OF PALM OIL MILL WASTE EFFLUENT,
Department of Chemistry (Malaysia).
S. Sinnappa.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 525-537, 1978. 2 Fig, 8 Tab, 5 Ref.

Descriptors: *Waste water treatment, *Agro-industries, *Water pollution control, *Biodegradation, *Malaysia, *Palm oil, Waste discharge, Effluents, Receiving waters, Standards, Experiments, Effects, Water resources.

The palm oil industry in Malaysia has grown rapidly to become one of the major revenue-earners for the country. However, the waste effluent produced from palm oil processing and its discharge into receiving streams and rivers have produced considerable damage to water resources. This paper describes a system of biodegradation procedures which enabled the resultant effluent to meet most requirements of the final standards proposed by the Division of the Environment. Details and results of the successful experimental studies are included. (Bell-Graf--Cornell)
W80-01656

STUDIES OF AN ANAEROBIC/AEROBIC TREATMENT PROCESS FOR A STRONG ORGANIC WASTE,

Monash Univ., Clayton (Australia). Dept. of Chemical Engineering.
G. A. Holder, G. J. Sewards, and P. H. Scott.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 539-549, 1978. 11 Fig, 3 Tab, 8 Equ, 5 Ref.

Descriptors: *Waste water treatment, *Aerobic treatment, *Anaerobic treatment, *Organic wastes, *Dairy whey, Design, Equations, Waste disposal, Estimating, Stability, Stability, Treatment processes, Treatment facilities, Methane, Cell synthesis, Cell wastage, Cell mass change, Net rate, Substrate removal, Growth rate constant, Metabolism.

The objective of these studies is to develop laboratory procedures and design equations for the decomposition of biologically-degradable strong organic wastes. The particular waste being used for the present studies is dairy whey. This is a useful material from the point of view of developing design procedures, since it is readily obtainable, strong, fairly uniform in composition, homogeneous (i.e., no suspended solids), and degrades both aerobically and anaerobically. It also presents a serious disposal problem in many countries. (Bell-Graf--Cornell)
W80-01657

OIL SEPARATION FROM OILY WASTEWATER BY INCLINED PLATES,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
N. C. Thanh, and U. Thipsuwan.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 553-565, 1978. 11 Fig, 1 Tab, 14 Ref.

Descriptors: *Waste water treatment, *Oil, *Oily waste water, *Gravity separation, *Separators, *Effects, *Performance, Improvement, Design, Experiments, Effluents, Contaminants, Temperature, Mineral oil, Oil refineries, Overflow rate, Oil concentrations, Hydrogen ion concentration.

Reviewed are the essential elements of gravity separation of oil from oily wastewater, the development of oil plate separators and the ensuing improvement in performance compared with the standard API separator. The design of a corrugated plastic separator is presented. The results of an experimental study on mineral-oil contaminated effluent at an oil refinery are presented for the effects of overflow rate, initial oil cncentrations, temperature and pH on the separator performance. Overflow rate and initial oil concentrations are evaluated for the optimum performance of the separator. To enhance the oil removal in the effluent, oily wastewater was heated and pH was adjusted to acid or basic side. (Bell-Graf--Cornell)
W80-01658

INDUSTRIAL WASTEWATER TREATMENT PROCESS USING GRANULAR ACTIVATED CARBON,
Yokohama National Univ. (Japan). Dept. of Safety and Environmental Engineering.
K. Urano, and V. Chanyasak.
In: Water Pollution Control in Developing Countries. Proceedings of the Intenational Conference, Bangkok, Thailand (Pergamon Press in USA), p 567-572, 1978. 2 Fig, 2 Tab, 3 Ref.

Descriptors: *Waste water treatment, *Adsorption, *Design, *Assessment, *Industrial wastes, *Feasibility, *Granular activated carbon, Organic pollutants, United States, Tertiary treatment, Standards, Water quality, Public health, Industrial applications, Domestic applications, Lab techniques.

This paper describes the application of granular activated carbon in the industrial wastewater treatment process. Many types of granular activated carbon for wastewater treatment are supplied by 10 companies in Japan. Design criteria such as space velocity, flow rate, configuration system and regeneration method of spent carbon are developed for four operation modes of the treatment process. There are about 140 industrial wastewater treatment plants using granular activated carbon, and many types of furnaces for the regeneration of spent carbon have also been developed in Japan. (Bell-Graf--Cornell)
W80-01659

USE OF GRANULAR ACTIVATED CARBON FOR TREATING INDUSTRIAL WASTEWATERS,
Calgon (Merck), Pittsburg, PA.
V. Wu.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 573-588, 1978. 6 Fig, 9 Tab, 2 Ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Adsorption, *Design, Industries, Evaluation, Biological treatment, Separation techniques.

Treatment of organic waste materials present in industrial and municipal wastewaters has been traditionally accomplished by combining liquid-solid separation techniques and biological processes. As an alternative, the technology of granular activated carbon adsorption has been applied to remove organic pollutants from wastewater. The reasons for the choice of activated carbon as an adsorbent are several-fold. Carbon has been demonstrated to have good sorption characteristics for most organic compounds. This paper describes the laboratory techniques and systems designs used in assessing the feasibility of granular activated carbon for a specific application. Examined also are case studies of industrial and domestic wastewater applications of activated carbon in the United States. (Bell-Graf--Cornell)
W80-01660

SIMULATION AND PROCESS DESIGN OF DEEP BED FILTRATION,
Syracuse Univ., NY. Dept. of Chemical Engineering and Materials Science.
C. Tien.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 589-595, 1978. 2 Fig, 18 Equ, 9 Ref.

Descriptors: *Simulation analysis, *Water treatment, *Deep bed filtration, *Filter coefficient, *Particle deposition, Estimating, Equations, Filters, Effects, Performance, Design, Flow rate.

The performance of a deep bed filter is characrerized by the quality of the filtrate it produces and the pressure drop across the bed necessary to maintain a constant flow rate. Based on recent theoretical advances, procedures for simulating the dynamic behavior of deep bed filtration are presented. The results of RAJAGOPALAN and TIEN (1976) are used for the estimation of the filter coefficient, and the effect of deposition on filter performance is analyzed on the basis of assumed deposit morphology. An example is given to demonstrate the method. (Bell-Graf--Cornell)
W80-01661

COMBINED TREATMENT WITH OZONE AND ACTIVATED CARBON,
Degremont S. A., Rueil-Malmaison (France).
Y. Richard, and L. Brener.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 607-615, 1978. 6 Fig, 1 Tab.

Descriptors: *Water treatment, *Ozone, *Activated carbon, *Industrial plants, Sand filtration, Clarification, Chloroform, Treatment line, Organic matter, Bacteria, Filters, Influents, Halogen derivatives, Raw water.

The condition for the use of ozone and activated carbon can now be specified on the basis of the first long test carried out at the industrial plant at Morsang-sur-Seine. Good results were obtained with a treatment which combines clarification with sand filtration followed by second stage through granular activated carbon. Results can be very appreciably improved by ozonation between the two stages of filtration. (Bell-Graff--Cornell)
W80-01663

A COMPARATIVE STUDY OF HIGH RATE BIOLOGICAL FILTERS,
Malaya Univ., Kuala Lumpur, (Malaysia). Dept. of Civil Engineering.
G. T. Tan.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 619-624, 1978. 1 Fig, 3 Tab, 2 Equ, 9 Ref.

Descriptors: *Waste water treatment, *Trickling filters, *Biological treatment, Plastic media, High rate filters, Pilot plant operation, Comparison.

A comparative study of high rate biological trickling filters was conducted using four types of plastic media viz. the two modular types (Floor and Surfpac), the random type (Filterpak) and the tubular type (Cloisonyl). Their BOD removal characteristics were fitted into a mathematical model following a first order kinetic reaction, Their fits being statistically highly significant. The overall results showed that Filterpak gave consistently better BOD removal performance. (Bell-Graf--Cornell)
W80-01664

PLASTICS MEDIA FOR TREATMENT OF INDUSTRIAL AND MUNICIPAL WASTEWATER,
Imperial Chemical Industries Ltd., Hyde (England).
M. L. Hemming, and J. Lunt.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 625-630, 1978. 1 Fig, 7 Ref.

Descriptors: *Waste water treatment, *Plastics media, *Treatment facilities, *Industrial wastes, *Municipal wastes, *Biological treatment, Design, Activated sludge, Costs, Effluents, Flotation, Removal efficiency, History, Mineral media filters, Palm oil.

This paper discusses the development of plastic media for biological treatment of waste waters and the characteristics of the media for different applications. It outlines the design parameters used for plants utilizing plastic media and the advantages and disadvantages of the system. Case histories of operational plants are then discussed both for industrial and municipal waste waters. Examples are considered where plastics media is used in combination with conventional biological systems such as activated sludge and mineral media filters. Examples are also quoted where plastics media may be used following flotation for the treatment of palm oil effluent. (Bell-Graf--Cornell)
W80-01665

DEODORISATION USING BIOLOGICAL TRICKLING FILTER,
Malaya Univ., Kuala Lumpur. (Malaysia). Dept. of Civil Engineering.
G. T. Tan.

In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 631-637, 1978. 2 Fig, 1 Tab, 4 Ref.

Descriptors: *Waste water treatment, *Trickling filters, *Biological treatment, *Deordorisation, Sewage, Biochemical oxygen demand, Hydraulic loading, Rock medium, Plastic medium.

Deodorisation of foul air from a sewage treatment plant using plastic and rock biological trickling filters was studied. Microbiological reaction is essential for deodorisation while chemical changes are insignificant. The optimum deodorising filter condition is related principally to the type of media, hydraulic and BOD loadings. At such conditions, the more sensitive rock filter is able to achieve satisfactory deodorisation with an air flow of less than 130 l/sm2. The plastic medium is able to do this only at higher hydraulic and BOD loadings permitting higher air flow. At comparative air and hydraulic flows, the rock filter is more effective for deodorising. (Bell-Graf--Cornell)
W80-01666

UPFLOW ANAEROBIC FILTER: A SIMPLE SEWAGE TREATMENT DEVICE,
National Environmental Engineering Research, Inst., Nagpur (India).
V. Raman, and A. N. Khan.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 639-649, 1978. 4 Fig, 4 Tab, 7 Ref.

Descriptors: *Waste water treatment, *Filtration media, *Surface waters, *Flow rate, Removal efficiency, Treatment efficiency, Head loss, Projects, Reservoirs, Malaysia.

The upflow anaerobic filter can be used successfully as a simple secondary treatment device for treating septic tank effluent and settled domestic sewage, or used as a composite sewage treatment unit. The filter consists of stone media of size 1.9 cms to 2.5 cms filled to a depth of 75 cms to 120 cms with the flow from bottom to top, operating at a hydraulic rate approximating to that of a low rate trickling filter. Studies show an average removal of 70 to 80 per cent of applied BOD and complete removal of helminthic ova in the filters serving as secondary treatment units. They are simple to construct, operate at low head loss, and are relatively free from nusiance. These may get clogged up after 1 1/2 to 2 years of continuous operation, but occasional flushing by water from the top can prolong their life. (Bell-Graf--Cornell)
W80-01667

OPTIMAL FLOW PATTERNS IN ACTIVATED SLUDGE PROCESS,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
E. A. R. Ouano, and M. G. Dissanayake.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 661-668, 1978. 3 Fig, 1 Tab, 6 Equ, 12 Ref.

Descriptors: *Waste water treatment, *Activated sludge, *Flow patterns, *Dispersed growth reactor, *Autocatalytic nature, Equations, Substrate concentration, Sucrose, Recycle sludge concentration, Efficienceis, Reactor volume, Optimal.

Analyzed is the autocatalytic nature of substrate degradation and microbial growth in activated sludge process; examined are the optimal mixing flow patterns to yield the best effluent quality. When using a sucrose based substrate, the completely mixed activated sludge was found to be superior to the conventional or plug flow activated sludge if the desired removal efficiency is less than 91%. The two processes have very little differences between 91% to 97% removal efficiency, whereas the plug flow process has the advantage above 97% removal efficiency. Since most activated sludge processes are operated with substrate removal efficiencies between 90-98%, the superiority of one process over the other is not very well defined resulting in different conflicting claims. (Bell-Graf--Cornell)
W80-01668

DEEP TANK AERATION-FLOTATION FOR BIOLOGICAL PROCESSING,
Idaho Univ., Moscow. Dept. of Chemical Engineering.
M. L. Jackson.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 669-674, 1978. 7 Equ, 10 Ref.

Descriptors: *Waste water treatment, *Design, *Aeration-flotation, *Deep tank fermentation system, *Dispersed growth reactor, *Biological processing, Economics, Paper mills, Biological sludge growth, Potato processing wastes, Single cell protein, Solids separation, Dissolved gas, Sulfite pulp mills, Oxygen, Equations.

Deep tank fermentation systems offer advantages of low air requirements, little mechanical equipment, small land space, and lower capital needs. Air input to meet oxygen demand can be predicted from design equations developed. The economics and design for applications are summarized by three examples: reduction of a waste water from a paper mill, growth of a biological sludge on a diluted sulfite waste liquor, and growth of single cell protein on potato waste solubles. The combination of the deep tank biological reactor and solids separation, using the inherent dissolved gas for flotation, effects a net reduction in energy requirements for overall processing. The high oxygen partial pressure at the bottom of a tall tank appears to offer some of the advantages claimed for the high purity oxygen process. (Bell-Graf--Cornell)
W80-01669

A MECHANISM FOR BIOLOGICAL DENITRIFICATION IN AERATED LAGOON SYSTEM,
Morinaga Milk Industry Co. Ltd., Tokyo (Japan). Central Research Lab.
K. Okada, K. Ogasa, K. Yamamoto, and N. Ishibashi.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 675-680, 1978. 5 Fig, 2 Tab, 5 Ref.

Descriptors: *Waste water treatment, *Oxygen, *Effects, *Experiments, *Aerated lagoons, *Biological denitrification, Activated sludge, Aerobic conditions, Nitrous oxide, Nitrogen, Performance pattern, Treatment facilities.

This paper examines the influence of oxygen on the process of denitrification with both isolated denitrifying bacteria and activated sludge to elucidate the mechanism of biological denitrification in the aerated lagoon system under aerobic conditions. Based on experimental results, two mechanisms are presented. The first is the denitrificarion process whereby the terminal product is nitrous oxide. Denitrifying bacteria reduces nitrate to nitrous oxide gas under high oxygen concentration levels. One possible mechanism of this aerobic denitrification was hypothesized as denitrification due to nitrous oxide gas formation. In the other denitrification process, the terminal product is nitrogen gas. In the case of activated sludge, nitrate was reduced to nitrogen gas even under high oxygen concentration levels. Nitrogen gas formation by activated sludge appeared to be dependent on the activity of denitrifying bacteria and floc size of sludge. So, this denitrification by sludge could be caused by the existence of anaerobic regions in activated sludge. (Bell-Graf--Cornell)
W80-01670

COMPARISON AND SELECTION OF RATIONAL-BIOLOGICAL-TREATMENT PROCESS FOR HANDLING CARBOHYDRATE WASTEWATER,
Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.
P. Y. Yang, and M. F. Kong.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lonani & N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 681-693, 1978. 7 Fig, 5 Tab, 1 Equ, 17 Ref.

Descriptors: *Waste water treatment, *Comparison, *Biological treatment, *Carbohydrates, Performance, Equations, Treatment facilities, Trickling filters, Anaerobic, Removal efficiency, Organic loading rate, Solid retention time, Activated sludge

The concepts of solid retention time (SRT) and organic loading rate were used as the basic parameters in the comparison of process performances, such as COD removal efficiency, sludge production and sludge volume index (SVI). Synthetic sucrose wastewater was used in operation of the laboratory pilot plant. It was found that the activated sludge process had the highest COD removal efficiency (79 to 95%) while the trickling filter had the lowest sludge production (0.034 to 0.683 kg/m cu/day) and SVI (10 to 52.6) within the organic loading of 0.226 to 5.6 kg COD/m cu/day and the SRT ranging from 2 to 23.8 days. Based on the present study, a decision to select a treatment process, both trickling filter and anaerobic contact processes could possibly be used. When high effluent quality was required, activated sludge process was shown to be pertinent to single secondary treatment. As a tertiary treatment process, the trickling filter process was found to be technically and economically suitable. (Bell-Graf--Cornell)
W80-01671

MICROBIAL TREATMENT AND UTILIZATION OF NIGHTSOIL,
Taiwan Inst. of Environmental Sanitation, Taipei.
M C Lo
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lonani & Thanh. Asian Institute of Technology, Bangkok, Thailand, (Pergamon Press in USA) p 701-707, 1978. 1 Fig, 3 Tab.

Descriptors: *Sludge, *Microbial treatment, *Nightsoil, *Chlorella, *Anaerobic digestion, *Aerobic digestion, Trickling filters, Pretreatment, Optimum control, Winter, Summer, Chicken feed, Eggs, Activated sludge

This study is divided into two stages. The first stage deals with the efficiency of nightsoil treatment with photosynthetic bacteria (P.S.B.) and chlorella. The duration of nightsoil treatment with PSB and chlorella proved to be 20 days faster than the traditional activated sludge or trickling filter method, and 10 days faster than the aerobic digestion method. Furthermore, much less sludge was produced. The second stage concerns the comparison of the by-product 'chlorella for chicken feed' with ordinary commercialized feed. In meat chicken it saved 14-20% in cost; in layer chicken 18.16%; in egg production 16.29%; and in egg weight, 4.9% more than that of average eggs. (Bell-Graf--Cornell)
W80-01673

THE DESIGN AND SELECTION OF MECHANICAL AERATION DEVICES,
Lightnin Mixer Pty Ltd., Camberwell (Australia).

J. A. Shaw.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & C.N. Thanh. Asian Institute of Technology, Bangkok, Thailand, (Pergamon Press in USA), p 709-722, 1978. 13 Fig.

Descriptors: *Design, *Mechanical aeration, *Aerators, *Activated sludge, *Biological treatment, *Mixing, Waste water treatment, Performance criteria, Circle of influence, Basin depth, Energy relationships, Continuous flow basin dynamics, Impeller synergism, Equations, Cyclic changes, Mixed lagoons.

Mechanical aerators have been developed as a cost effective replacement for traditional diffused air aeration. They include aerators of several types--high or low speed surface, submerged turbine, combined submerged and surface, and draft tube. Each type has certain strengths and weaknesses. This equipment has two functions--aeration and mixing. Proper consideration of the mixing function is an essential part of aeration system design. Design for the aeration function must be related to the actual tests conducted on the aerator under standard conditions. But recent work has revealed serious defects in the traditional aerator test method. More refined test procedures have disclosed the importance of parameters which had previously been overlooked. Mechanical design of aeration equipment is more demanding than popularly supposed. In addition to impellers, shafts and shaft support systems speed reducer type, design and ratings are of critical importance. The design of both fixed and floating platforms also requires careful consideration of certain factors. Mechanical aerators have wide application in Asian countries for major plants, simple ponds for small communities as a key element in integrated modular treatment plants. (Bell-Graf--Cornell)
W80-01674

THE IMPROVEMENT OF THE PERFORMANCE OF THE PURIFICATION OF MUNICIPAL AND INDUSTRIAL SEWAGE WATER WITH COAGULANTS AND FLOCCULANTS,
Chemische Fabrik Stockhausen and Cie., Praestol-Marken (Germany, F.R.).
I. Reuter.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference. held at Bangkok, Thailand, February 1978. Edited by E. A. R. Ouano, B. N. Lohani & N. C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 723-727, 1978. 1 Fig, 1 Tab.

Descriptors: *Waste water treatment, *Purification, *Performance, *Municipal wastes, *Industrial wastes, *Coagulants, *Flocculation, Kinetics, Structure, Sludge, Dewatering.

Chemical coagulation and flocculation were applied to industrial and municipal wastewater to improve the overall treatment efficiency. Ferrous sulfate and aluminum sulfate at a dose of 100 mg/l could yield favorable results when each was used together with 1 mg/l of polymer. More than twice reduction of BOD and COD was achieved and better sludge dewatering efficiency was also obtained. (Bell-Graf--Cornell)
W80-01675

APPROPRIATE WASTE TREATMENT FOR TROPICAL CLIMATES: A STATE-OF-THE-ART REVIEW,
McGill Univ., Montreal (Quebec).
W. Rybczynski, C. Polprasert, and M. McGarry.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 735-742, 1978. 36 Ref.

Descriptors: *Waste treatment, *Tropical climates, *Technology, *Literature reviews, *Water supply, *Waste disposal, *Developing countries, Information sources, Review coverage, Composting, Reuse, Stabilization ponds, Projects.

This paper is a condensed version of part of a study that has recently been completed at the International Development Research Centre in Ottawa (RYBCZYNSKI et al., 1977). The aim of this project was to identify, through a review of the technical literature, the options that are available for waste treatment in tropical climates, and particularly for less-developed countries in those regions. This technology review has been conducted by IDRC, but it is also the first phase in a major research project of the World Bank dealing with appropriate technologies for water supply and waste disposal. (Bell-Graf--Cornell)
W80-01677

SUCCESSION OF ORGANISMS IN THREE-STAGE SEWAGE PONDS,
Institute of Meteorology and Water Management, Krakow (Poland).
For primary bibliographic entry see Field 5C.
W80-01754

THE COMPARABILITY OF OXYGENATION AND EFFICIENCY MEASUREMENTS,
Stuttgart Univ. (Germany, F.R.). Inst. fuer Siedlungswasserbau und Wasserguetewirtschaft.
F. Bingel.
Progress in Water Technology, Vol 11, No 3, p 89-99, 1979. 5 Fig, 1 Tab, 8 Ref.

Descriptors: *Oxygenation, *Aeration, *Laboratory tests, Measurement, Dissolved oxygen, Water temperature, Waste water treatment, Sewage treatment, Diffusion, Mixing, Oxygen, Air, Water treatment, Oxygenation capacity, Oxygenation efficiency.

Oxygenation capacity and efficiency measurements have a decisive influence on the performance and economy in planning and selecting an aeration system. The comparison of guaranteed values and controlled measurements well as the final appreciation of guaranteed values indicates important errors and obscurities, not only in the carrying out of experiments but also in their evaluation. Presented was a method designed to eliminate the errors which were described individually. (Sims-ISWS)
W80-01845

ON THE REOXYGENATION EFFICIENCY OF DIFFUSED AIR AERATION,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hydromechanik.
For primary bibliographic entry see Field 5G.
W80-01846

DIMENSIONLESS ANALYSIS OF CIRCULATION, MIXING AND OXYGENATION IN AERATION TANKS,
Technical Univ. of Denmark, Copenhagen. Dept. of Sanitary Engineering.
P. Harremoes.
Progress in Water Technology, Vol 11, No 3, p 49-57, 1979. 5 Fig, 5 Tab, 13 Ref.

Descriptors: *Aerobic treatment, *Sewage treatment, *Aerated lagoons, *Tanks, Laboratory tests, Model studies, Mathematical models, Diffusion, Mixing, Circulation, Velocity, Oxygen, Dissolved oxygen, Air, Oxygenation, Aeration, Waste treatment, Water treatment.

The rising plume of mixed air and water in an aeration basin was treated by analogy with the theory of a bouyant jet. It was shown that the characteristic velocity of the plume is (g Q sub o) to the 1/3 power, where g is the acceleration of gravity and Q sub o is supply of air per unit length of the aeration basin. The total circulation and the velocity at the bottom can be related directly to the characteristic velocity. This was shown by comparison with data from laboratory scale (40 cm) to full scale (4 m). The longitudinal dispersion in aeration basins was related to the Reynold's number for the rotational flow with the same characteristic velocity. Dimensionless analysis of data revealed that the longitudinal dispersion is related to the supply of air as D sub L related to (Q sub o) to the 0.42 power. The aeration capacity was related to geometry, the Froude number of the circulation, and the relative size of holes in the diffuser. However, analysis of model and full-scale data showed scale effects not yet accounted for. (Sims-ISWS)
W80-01847

RUNOFF CONTROL COMPARISONS FOR COMMERCIAL BEEF CATTLE FEEDLOTS,
Science and Education Administration, Lincoln, NE.
For primary bibliographic entry see Field 5G.
W80-01851

GRADATION OF GRANULAR MEDIA BY VOLUME,
Iowa State Univ., Ames. Dept. of Civil Engineering.
J. C. Young, and J. E. Wiskus.
Journals of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Technical Note, p 1011-1014, October 1979. 1 Tab, 1 Ref.

Descriptors: *Porous media, *Particle size, *Gradation, *Volumetric analysis, Analytical techniques, Methodology, Distribution, Filters, Measurement, Sands, Silica, Coals, Grain-size distribution.

This paper described a volumetric test procedure proposed to determine grain-size distribution of media used in water and wastewater filters. Laboratory test comparisons showed that measurement of size and gradation of granular media by volume rather than weight fractions provides a simple and rapid, yet accurate, method particularly suited to field use. Most specifications for media include a range such as 1.2 mm to 1.4 mm effective size with a uniformity coefficient less than 1.7. The volumetric method is sufficiently accurate to determine if media meet specifications. In borderline cases, more accurate weight measurements can be made. (Humphreys-ISWS)
W80-01858

CALCULATING OVERFLOWS FROM COMBINED SEWER SYSTEMS,
Black and Veatch, Kansas City, MO.
K. E. Larson.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE5, Proceedings Paper 14883, p 829-842, October 1979. 14 Fig, 3 Tab, 13 Ref, 2 Append.

Descriptors: *Sewers, *Combined sewers, *Overflow, *Model studies, Mathematical models, Precipitation(Atmospheric), Runoff, Storm runoff, Rainfall, Water pollution, Water pollution sources, Storage, Sewage treatment. Excessive precipitation, Precipitation excess, Statistical analysis, Analytical techniques, *Detroit(MI).

Determining annual overflows from combined sewers is essential for evaluating overflow impact on receiving waters. A statistical methodology was developed based on acceptable hydrologic principles and correlating data with a neighboring combined sewer district. Calculation begins with estimating the average annual set of rainfall events. These are converted into the average annual set of rainfall excesses by applying an infiltration index to previous areas and a depression storage value to impervious areas. For this calculation, rainfall excess can go to system storage, flow to the treatment plant, or overflow to natural water courses. The sum of overflows resulting from calculations on each of the 152 annual occurrences is the average annual value of overflow. The calculated values, correlated with the neighboring district, were within 2% of those observed when comparing average annual rainfall excess, flow to treatment plant, and overflows. (Sims-ISWS)
W80-01862

CONTINUOUSLY OPERATED LIQUID-SOLIDS SEPARATOR,
National Petro Chemicals Corp., New York. (Assignee).

G. Romano, and M. A. Rismondo.
U.S. Patent No 4,163,723, 8 p, 6 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 150, August 7, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Suspended solids, Resins, Water purification, Equipment.

The invention relates to an apparatus or separator for continuously separating a powered resin material, such as finely-divided high-density polyethylene particles, which is suspended in water and supplied to the separator as an infeed slurry, by permitting the resin, which is of a lower specific gravity than the water, to float upwardly within a vessel where it is withdrawn as a thickened slurry through an outlet orifice located in the upper portion of the vessel. The infeed slurry is fed into the lower central section of the vessel, and an outlet orifice for clarified water is provided in the base portion. Anti-swirl baffles in the form of vertically extending plate members are located in circumferentially spaced relationship inside the vessel in the upper regions in order to restrict the undue agitation and swirling of the resinous material and limit resultant downward movement. Agitation is imparted to the thickened slurry in the uppermost region of the vessel through a suitable rotatable impeller mounted in the upper section of the vessel at a level below the outlet orifice in order to maintain the accumulated resin uniformly dispersed as it is being withdrawn from the separator. (Sinha-OEIS)
W80-01934

APPARATUS FOR THE BIOLOGICAL PURIFICATION OF WASTE WATER,
PEC Process Engineering Co., S.A., Maennedorf (Switzerland). (Assignee).
H. Mueller.
U.S. Patent No 4,163,720, 7 p, 4 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 148, August 7, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Organic wastes, Biological treatment, Aeration, Aerobic treatment, Anaerobic conditions, Equipment.

An apparatus is provided for the multistage biological purification of waste water containing organic substances including carbohydrates and proteins. The apparatus comprises a substantially closed first tank for holding waste water while maintaining the waste water free from contact with air so as to prevent further oxygen from becoming dissolved in the waste water. The apparatus also includes a second tank including an aerator for dissolving oxygen in waste water. The second tank is located inside the first tank and includes a conical bottom portion for receiving sludge produced by aerobic degradation of the waste water in the second tank. (Sinha-OEIS)
W80-01935

PROCESS FOR THE PURIFICATION OF CONTAMINATED WATER,
Feltex Ltd., (South Africa). (Assignee).
R. H. Turnbull.
U.S. Patent No 4,163,716, 5 p, 1 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 147, August 7, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Dyes, Ion exchange, Electrolysis, Separation techniques, Color, Heavy metals.

The invention concerns a process for the purification of acid dyehouse effluent from a dyeing process, which is contaminated with coloured substances and heavy metal ions. After removal of fibers, the effluent is subjected to ion exchange to remove surface active agents and is then subjected to electrolysis with an iron cathode. Ferrous and ferric hydroxide is formed and the ferrous and ferric hydroxide together with the colored substances and heavy metal ions are removed from the effluent liquid. The liquid which remains is recycled to the dyehouse. (Sinha-OEIS)
W80-01937

METHOD FOR TREATMENT OF WASTE WATER,
Agency of Industrial Science and Technology, Tokyo (Japan). (Assignee); and Sumitomo Jukikai Envirotech, Inc., Tokyo (Japan). (Assignee).
Y. Ikari, S. Yokoyama, and K. Katoh.
U.S. Patent No 4,163,715, 6 p, 1 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 146-147, August 7, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Color, Chemical oxygen demand, Adsorption, Separation techniques, Inorganic compounds.

In removing color components and COD components from waste water, the waste water is treated with an inorganic adsorbent such as magnesia adsorbent. The mixture of the adsorbent and waste water thus obtained as subjected to a sedimentation treatment to separate the adsorbent as a slurry layer from a water layer. A portion of the adsorbent slurry is returned to the adsorption step. The remainder of slurry is transferred to a dehydration step. Water separated at the sedimentation step can be directly discharged since the color and COD value are very low. However, sometimes a little solid matter mainly composed of fine inorganic adsorbent may be contained in the water. In such a case, further treatment such as coagulation treatment or activated sludge treatment may be conducted. (Sinha-OEIS)
W80-01938

SEWAGE DISPOSAL SYSTEM,
A. A. Monson.
U.S. Patent No 4,162,976, 9 p, 5 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 5, p 1197, July 31, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Waste disposal, Evaporation, Anaerobic conditions.

A four stage sewage disposal system is described in which sewage from residential or commercial buildings is received in an underground tank assembly. The system receives and completely destroys waste solids biochemically and disposes of the effluent by total evaporation within a sealed dispersion reservoir surrounding the two stage tank assembly. Raw sewage is reduced in first and second stages of anaerobic digestion in upper and lower tank units of the double tank assembly. Liquid effluent is forced outward through discharge openings in the lower tank unit and upward through a rock bed in the dispersion reservoir under the pressure of a liquid column in the upper tank unit. The liquid effluent evaporates in the rock bed as the third stage of disposal, with the resulting vapors being filtered through a sand bed over the rock bed and dispersed to the atmosphere in a fourth and final stage. (Sinha-OEIS)
W80-01941

WATER POLISHING SYSTEM,
AFL Industries, Inc., Chicago, IL. (Assignee).
W. M. Lynch.
U.S. Patent No 4,162,973, 12 p, 7 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 984, No 5, p 1196, July 31, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, Suspended solids, Oily water, Filtration, Coalescence, Water reuse, Modular units.

Waste water containing pollutants such as suspended solids and emulsified oil is pumped continuously through a self-contained separating or polishing system utilizing a simplified plug-in module to remove the pollutants. The suspended solids are removed by mechanical filtration and the emulsified oil is separated by coalescing oil into floatable droplets which can be skimmed from a water surface and withdrawn for external accumulation. The treated waste water may be returned for further use or pumped to other facilities for further treatment. (Sinha-OEIS)
W80-01942

REMOVING PHENOLS FROM WASTE WATER,
Metallgesellschaft A.G., Frankfurt am Main (Germany, F.R.). (Assignee).
P. Wiesner, and H-M. Stonner.
U.S. Patent No 4,172,902, 4 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 5, p 1175, July 31, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Phenols, Separation techniques, Solvent extractions, Carbon dioxide, Hydrogen sulfide, Ammonia, Coal gasification.

A process for removing phenols from waste water resulting from the gasification or carbonization of coal and containing C02, and H2S and NH3, comprises mixing the waste water with a low-boiling organic solvent, separating the mixture into a solvent layer and an aqueous layer, stripping off from the aqueous layer under superatmospheric pressure the vapors of C02, H2S and organic solvent, then stripping off from the aqueous layer the NH3, leaving a refined aqueous product layer suitable for discharge. The stripped vapors are scrubbed under superatmospheric presssure with a portion of the cold refined product to remove organic solvent. Part of the solvent is condensed and separated under superatmospheric pressure. The remaining acid gases still containing ammonia and solvent are scrubbed with recirculated cooled raw phenol to remove the ammonia and solvent. (Sinha-OEIS)
W80-01944

WATER REUSE SYSTEM,
G. L. McCormick
U.S. Patent No 4,162,218, 8 p, 2 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 984, No 4, p 936, July 24, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water reuse, Domestic wastes, Domestic water, Filtration, Water storage, Storage tanks, Gray water.

A used water reuse system includes a gray water holding tank to which gray water is supplied up to a maximum level through a filter and gray water drain line. Gray water sources such as kitchen and bathroom sinks, clothes and dishwashers, tubs and showers, and the like have drains connected through valves to the gray water drain line and to a conventional sewer line. Gray water is transferred, upon demand, from the gray water holding tank to noncritical water use devices, such as a toilet tank, for reuse and subsequent discarding. A sensor detects achievement of a maximum level in the gray water holding tank and causes the valves at the gray water sources to disconnect the latter from the gray water drain line, so as to discard any further gray water from the sources to the sewer line, and also closes a fail-safe valve to preclude flow from the gray water line to the gray water holding tank. Upon reduction of tank water level the sensor reopens the valves. A further sensor notes draining of the tank to a preselected minimum level for admitting fresh water. (Sinha-OEIS)
W80-01945

BIOLOGICAL TESTING DEVICE AND METHOD OF MEASURING TOXICITY OF SEWAGE,
Aktiebolaget Kalle-Regulatorer, Saffle (Sweden). (Assignee).
P. Solyom, B. Boman, and H. Bjorndal.
U.S. Patent No 4,162,195, 10 p, 7 Fig, 1 Ref; Official Gazette of the United States Patent Office, Vol 983, No 4, p 930, July 24, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Sampling, On-site tests, Toxicity, Biological treatment, Aeration, Oxygen demand.

To test sewage for the possible presence of substance which are toxic with respect to sewage biological purification microorganisms, a sample of the sewage is positively provided with a dissolved oxygen content and is then subjected to the action of microorganisms in a biological mass competely submerged in the sample. The volume of the biological mass is controlled to keep it at a constant level. Thereafter the oxygen content of the sample is measured, and if this content is found to be high, it is known that the sample contains toxic substances and that the sewage sample should be treated otherwise than biologically. (Sinha-OEIS)
W80-01946

APPARATUS FOR TREATING EFFLUENTS,
Krupp-Koppers G.m.b.H., Essen (Germany, F.R.). (Assignee).
W. Haverkamp.
U.S. Patent No 4,162,147, 6 p, 3 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 984, No 4, p 916, July 24, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial waste, *Water pollution treatment, Aeration, Flow, Equipment, Nozzles.

An aparatus for removing harmful substances from effluents has two chambers located symmetrically at opposite sides of an effluent channel. Each chamber contains two or more stacked trays which are each provided with a spiral path descending from a tray inlet to a tray outlet. All tray inlets are so located in the channel that substantially all effluent flowing in the channel is compelled to enter them and to travel by gravity through the respective tray. Air, an inert gas or a mixture of both is bubbled from below through the effluent flowing in the trays to expel and entrain the harmful substances. The treated effluent is then discharged back into the channel at locations downstream of its point of admission into the inlets. (Sinha-OEIS)
W80-01947

PROCESS FOR THE REMOVAL OF METALS FROM SOLUTION,
Louvain Research and Development VZW (Belgium).
A. E. J. Cremers, A. P. A. Maes, and P. G. L. Piegneur.
U.S. Patent No 4,167,481, 7 p, 9 Ref; Official Gazette of the United States Patent Office, Vol 986, No 2, p 412, September 11, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, Metals, Cation exchange, Polymers, Clay minerals, Adsorption.

Several metal ions, such as mercury, cadmium, copper, zinc, nickel and cobalt, may be removed from waste waters and similar solutions by treating such solutions with a cation exchanger in the presence of a polyamine. A treatment with clay minerals such as bentonite or montmorillonite in the presence of tetraethylenepentamine is preferred. The solution may be first combined with polyamine and then contracted with the cation exchanger, but in a preferred embodiment, the polyamine and cation exchanger are combined first to form a solid adsorbent and then contacted with the solution. (Sinha-OEIS)
W80-01948

PROCESS FOR PURIFYING WASTE WATERS,
F. Besik.
U.S. Patent No 4,167,479, 14 p, 5 Fig, 3 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 986, No 2, p 411, September 11, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Oxygen, Chemical reactions, Chemical precipitation, Biodegradation, Phosphates, Denitrification.

A purification process for the removal of biodegradable suspended and dissolved organic solids, nitrogenous compounds and phosphates from contaminated water by biological and chemical reactions is carried out simultaneously in active media of a biological waste treatment reaction system. The process comprises adding a finely divided mineral or mixture of minerals to the reaction system. Various levels of oxygen in the system are maintained to provide for biological oxidation of organic compounds and biological nitrification of nitrogen containing compounds and subsequent biological denitrification of the formed nitrites and nitrates. The selection of the mineral is such that through its dissociation in the system, the released metal ions are capable of precipitating a portion of ionic species, particularly phosphates present in the processed waste water, at the operating pH range of 6 to 8. The surfaces of the mineral attract microorganisms and suspended solids to facilitate and enhance simultaneously occurring biological and chemical reactions. (Sinha-OEIS)
W80-01958

SINGLE STAGE PROCESS FOR CONTINUOUS INTRODUCTION OF OXYGEN-CONTAINING GASES INTO EFFLUENT CONTAINING ACTIVATED SLUDGE,
Bayer A.G., Leverkusen (Germany, F.R.). (Assignee).
M. Zlokarnik, H. Guth, and T. Mann.
U.S. Patent No. 4,166,790, 7 p, 2 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 986, No 1, p 169, September 4, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Activated sludge, Oxygen, Equipment, Nozzles, Gases.

In a process and apparatus for the continuous introduction of air or oxygen-containing gases into an effluent containing activated sludge, the oxygen-containing gas is largely consumed by the effluent in a single absorption stage. The process introduces the gas through a plurality of gas inlets into a basin under its own hydrostatic pressure of a least 0.9 bar. The gas pressure of the gas introduced is about 0.01 to 0.5 bar above the hydrostatic pressure prevailing at the inlet. The individual gas inlets are separated by a distance of about 0.5 meter, as measured from the middle point of the gas inlet. The gas inlets may be nozzles, ejectors or apertured plates prefereably spaced equidistantly from one another and each may be supplied with propulsion liquid comprising effluent containing activated sludge. Preferred ranges from the various parameters depend upon whether the gas introduced contains more or less than 50% by volume of oxygen. Special gas injectors are also provided. (Sinha - OEIS)
W80-01967

IRRIGATED FIELDS FOR URBAN SEWAGE,
For primary bibliographic entry see Field 5E.
W80-01986

METHOD AND AN APPARATUS FOR PREVENTING DEPOSITS IN A PROCESS WATER SYSTEM FOR A GAS GENERATOR PLANT OR THE LIKE,
Motala Verkstad (Sweden). (Assignee).
H. E. Sundqvist.
U.S. Patent No. 4,166,499, 7 p, 8 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 986, No 1, p 78, September 4, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial water, *Separation techniques, Evaporation, Water vapor, Gases, Water pressure, Water reuse.

The invention is applicable to gas generator plants in which waste, such as garbage, bark and sewage sedimentation sludge is gasified and burned and the potential heat content of the waste is utilized in an economically favorable manner while at the same time, hydrocarbons such as phenols dissolved in water separated from the waste are prevented from being discharged to the surroundings. It has been suggested that the water soluble compounds should be refluxed to the gas generator together with water condensed on cooling. However, on the formation of vapor, the particles dissolved in the process water are precipitated and deposited on the walls, etc. of the conducting system. The object of this invention is to prevent deposits in a process water system for a gas generator plant of that kind. The plant has a pressure controlling means in the conduits for the process water connected to the heat exchanger. This pressure controlling means may consist of a pressure increasing means in the supply conduit for the process water or a pressure decreasing means in the return conduit for the process water. (Sinha-OEIS)
W80-01988

PROCESS FOR THE SEPARATION OF POLYVINYL ALCOHOL FROM AQUEOUS SOLUTIONS,
Hoechst A.G., Frankfurt am Main (Germany, F.R.). (Assignee).
W. Zimmermann, and H. Schindler.
U.S. Patent No. 4,166,033, 5 p, 2 Ref; Official Gazette of the United States Patent Office, Vol 985, No 4, p 953, August 28, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Hydrogen ion concentration, Chemical precipitation, Alkaline earth metals, Polyvinyl alcohol(PVAL).

Although Polyvinyl alcohol (PVAL) has no noxious effect on either plants or animals, it increases the chemical oxygen demand (COD) and the biological oxygen demand (BOD) of the waste water, and thus causes an undesirable environmental strain. This invention relates to a process for the separation of PVAL from an aqueous solution by precipitation of the PVAL in the presence of orthoborate ions and alkaline earth metal ions, in an alkaline medium, which comprises either adding first a saturated boric acid solution to the polyvinyl alcohol solution and then adjusting the latter one to a pH above 8 by means of an alklaline earth metal hydroxide solution; or adjusting first the polyvinyl alcohol solution to a pH of 11 by adding an alkaline earth metal hydroxide solution and then adding a boric acid solution neutralized by an alkaline earth metal hydroxide; and subsequently separating the precipitated polyvinyl alcohol. (Sinha-OEIS)
W80-01999

5E. Ultimate Disposal Of Wastes

ENERGY AND USEFUL BY-PRODUCT RECOVERY FROM ANIMAL WASTES,
Food and Agriculture Organization of the United Nations, Malaya (Singapore).
For primary bibliographic entry see Field 5D.
W80-01639

SOME PUBLIC HEALTH ASPECTS OF LEACHATE FROM LANDFILLS,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
C. Polprasert, and D. A. Carlson.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bankok, Thailand (Pergamon Press in USA), p 729-734, 1978. 1 Tab, 23 Ref.

Descriptors: *Public health, *Leachate, *Sanitary landfills, *Environmental effects, Waste disposal, Surface waters, Groundwater, Collection, Treatment, Physial aspects, Chemical composition, Pollution.

Leachate generated from sanitary landfills could become a potential source of environmental pollution both chemically and biologically. Evidences of surface and ground water contamination by leachate have been indicated in the literature. Most microorganisms present in the leachate were found to be in the growth inhibitory stage but they could reactivate again if entrance was gained into a more favorable environment and sufficient time was available to overcome their inhibitions to growth. A proper collection and treatment of landfill lea-

chate is recommended prior to its final disposal to the environment. (Bell-Graf--Cornell)
W80-01676

APPROPRIATE WASTE TREATMENT FOR TROPICAL CLIMATES: A STATE-OF-THE-ART REVIEW,
McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 5D.
W80-01677

A MASS BALANCE STUDY OF APPLICATION OF MUNICIPAL WASTE WATER TO FORESTS IN MICHIGAN,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 5B.
W80-01875

SEWAGE DISPOSAL SYSTEM,
For primary bibliographic entry see Field 5D.
W80-01941

IRRIGATED FIELDS FOR URBAN SEWAGE,
J. Wierzbicki.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 305, Price codes: A02 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Draft Translation 653, 1977, 8 p, 3 Fig, 3 Tab. Translated from Gaz woda i technika sanitarna, Vol 26, No 2, p 34-37, 1952.

Descriptors: *Sewerage, *Sewage treatment, *Sewage disposal, *Agriculture, *Irrigation, Sewage, Municipal wastes, Poland, Waste waters, Waste disposal, Pipelines, Percolation, Gravity, Flow, Treatment facilities.

A city in Lower Silesia, Poland, overcame difficulties in conducting urban sewage to a treatment plant by constructing a plant close to the city bypassing a nearby hill. Irrigation fields drain effluent flow and water is then conducted by a 2.3 km ditch to a stram 6.5 kr from the city. The city is located in slightly rolling terrain and no river or valley crosses the developed area. Another Polish city, Bydgoszcz used to pump it sewage water to fields 3.5 and five km away, with a 70 m manometric pumping height. Urban sewage, diluted by four artesian wells, averages 1100 cu m/d or 100 l/d/inhabitant. Because gravity sewage flow to a sewage treatment plant lowers community costs, this method was explored after buildings were destroyed during World War II. By conducting sewage water to irrigation fields by gravitational flow and constructing the treatment plant outside the city, costs were 30% of solely constructing a new system inside the city. Irrigation field soil was poor and sandy. Content or raw humus, phosphorus compounds, and potassium has favorably changed because of sewage irrigation effects, while acidity has increased. A humus load layer of 18-20 cm thick has formed and fruit trees, vegetables, and valuable grasses now grow on originally poor soils. (Danovich-Wisconsin)
W80-01986

5F. Water Treatment and Quality Alteration

LOW ENERGY MECHANICAL DESTRATIFICATION AND REAERATION OF RESERVOIRS,
Oklahoma Water Resources Research Inst., Stillwater.
For primary bibliographic entry see Field 2H.
W80-01601

SIMULATION AND PROCESS DESIGN OF DEEP BED FILTRATION,
Syracuse Univ., NY. Dept. of Chemical Engineering and Materials Science.
For primary bibliographic entry see Field 5D.
W80-01661

CHLORINATION SYSTEM ANALYSIS,
College of Engineering, Suraboya (Indonesia).
For primary bibliographic entry see Field 6A.
W80-01662

COMBINED TREATMENT WITH OZONE AND ACTIVATED CARBON,
Degremont S. A., Rueil-Malmaison (France).
For primary bibliographic entry see Field 5D.
W80-01663

DISINFECTION BY ULTRAVIOLET LIGHT,
Geo-Environ Ltd., Toronto (Ontario).
B. R. Whitehead.
Canadian Water Well, Vol 5, No 3, p 26-27, August, 1979. 2 Fig, 3 Ref.

Descriptors: *Disinfection, *Ultraviolet radiation, *Water treatment, Cost comparisons, Standards, Chlorination.

Ultraviolet (UV) light in wavelengths between 2000 and 2100 A has a lethal effect on microorganisms. The effectiveness of UV light depends on the radiation intensity, exposure time per unit area, and the chemical and physical characteristics of the water under treatment. Turbidity, color, organic substances and iron can reduce UV exposure and should be removed. Dirt on the lamp and excessive flow rates reduce UV exposure and should be corrected. The minimum exposure of UV for disinfection varies with pH, stage of the organism and with various species. A domestic UV unit manufactured by Trojan Environmental Products, Inc. of London has adequate sagfeguards for an effective disinfection. The advantages and disadvantages of UV treatment as opposed to conventional chlorination are listed. In general, UV treatment is more expensive and less effective than chlorination. (Purdin-NWWA)
W80-01722

WATER SYSTEMS BASICS,
Ground Water Age, Vol 14, No 1, p 69-74, September, 1979. 2 Fig.

Descriptors: *Water treatment, *Water analysis, *Water softening, Gases, Salts, Suspended solids, Microorganisms, Hardness(Water), Domestic water.

Water conditioning is an important part of all water systems and a profitable source of business for water systems contractors. Four basic types of impurities commonly treated are: dissolved gases, dissolved minerals, suspended matter, and microorganisms. The first step in treatment is water analysis. Guidelines for sampling and analysis of municipal water and individual well water supplies are presented. Hardness is a common problem which affects laundering, general housekeeping, cooking and drinking, and heating and plumbing. A water softener exchanges sodium ions for calcium and magnesium ions in the water until all the sodium is used up. The softener then automatically regenerates itself by backwashing with sodium chloride. (Purdin-NWWA)
W80-01735

SUCCESSION OF PHYTO- AND ZOOPLANKTON IN A WASTEWATER STORAGE RESERVOIR,
Mekorot Water Co., Tel Aviv (Israel).
For primary bibliographic entry see Field 5C.
W80-01758

GRADATION OF GRANULAR MEDIA BY VOLUME,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W80-01858

REMOVAL OF SILICA FROM MIXED BED DEMINERALIZER,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
R. A. Blind, R. T. Saterbak, and E. I. Wolfe.
U.S. Patent No 4,163,717, 8 p, 2 Fig, 2 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 147, August 7, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, *Demineralization, Separation techniques, Anion exchange, Cation exchange, Silica, Resins, *Regeneration, Mixed bed demineralizer.

It has been discovered that when the anion and cation exchange resins of a mixed bed demineralizer are regenerated according to the technique described, substantially complete removal of silica from water can be obtained. This result is premised on the discovery that silica is removed by the cation exchange resin as well as by the anion exchange resin. In order to obtain ultralow levels of silica in water, it has been found necessary to modify the prior procedures for regenerating mixed bed ion exchange resins and pass initially only from about 30 to about 80 volume % of the anion regenerant solution through the anion exchange resin. This effects a partial regeneration of the anion exchange resin by removing the silica and other mineral salts while avoiding contamination of the cation exchange resin. The remaining portion of the anion regenerant solution is then passed through both the anion and cation exchange resins. The subsequent treating of both the anion and cation exchange resins serves to complete the regeneration of the anion exchange resin as well as to remove the silica from the cation exchange resin. (Sinha-OEIS)
W80-01936

TRICKLE IRRIGATION WATER QUALITY AND PREVENTIVE MAINTENANCE,
Science and Education Administration, Phoenix, AZ. Water Conservation, Lab.
D. A. Bucks, F. S. Nakayama, and R. G. Gilbert.
Agricultural Water Management, Vol 2, No 2, p 149-162, June 1979. 3 Fig, 6 Tab, 11 Ref.

Descriptors: *Irrigation operation maintenance, *Emitters, *Irrigation practices, *Application equipment, *Trickle irrigation, *Water quality, Irrigation systems, Maintenance, Water distribution(Applied), Water supply, Irrigation design, Irrigation efficiency, Filtration, Inspection, Pipelines, Distribution systems.

With trickle irrigation systems, emitter clogging is a serious problem that can adversely affect both the rate of water application and uniformity of water distribution, increase operating costs, and destroy the grower's confidence in the system. Here the authors set forth guidelines and recommendations for preventive maintenance of trickle systems, including proper filtration, field inspection, and, under some conditions, chemical treatment and pipeline flushing, with emphasis on improving the quality of water before it reaches the emitters. Based on recognition of the prime importance of water quality in the design and operation of this maintenance program, a tentative water classification system is developed to establish criteria for evaluating the clogging potential of a trickle irrigation water supply. (Tickes-Arizona)
W80-01955

5G. Water Quality Control

A RATIONAL WATER QUALITY CONTROL POLICY,
Birmingham Univ. (England). Dept. of Civil Engineering.
T. H. Y. Tebbutt.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Intitute of Technology, Bangkok, Thailand (Pergamon Press, Inc. in USA), p 31-36, 1978. 3 fig.

Descriptors: *Water quality control, *Water policy, *Rational approach, *Waste water treatment, Effluents, Standards, Effects, Flow, Bio-

chemical oxygen demand, Costs, Benefits, Decision making, Planning, Least-cost solution.

The emergence of environmental lobbies in various countries has resulted in demands for more stringent water pollution control policies. There are growing trends to require the use of the best available technology for wastewater treatment without full justification for the requirement other than in emotive terms. In almost all situations, the removal of contaminants from wastewater becomes increasingly more difficult as the allowable levels in effluents are reduced. Before adopting such high standards it should be shown that the requirements have a sound economic basis and that the benefits to the community by the same expenditure in other areas of health and welfare would not be greater. (Bell-Graf--Cornell)
W80-01611

WATER QUALITY MANAGEMENT,
Urban Development and Public Health Department Mantralaya, Bombay (India).
S. T. Khare.
In: Water pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc. in USA), p 37-41, 1978.

Descriptors: *Water quality control, *Management, *Developing countries, *Maharashtra State(India), Environmental protection, Water utilization, Irrigation, Domestic requirements, Industrial requirements, Objectives, Programs, National strategy, Data needs, Standards, Streams.

There has been an increasing awareness for environmental protection activities in developing countries, and many States are launching ambitious programs in this field. India is one such country where work has begun on pollution control. An Act for the prevention of water pollution was passed by Maharashtra State in 1969, followed by the Government of India in 1974, and now almost all States have adopted the same. In implementing the Act, many problems have to be faced. Water quality management forms an important field in water pollution control. The various aspects of water quality management are discussed herein. (Bell-Graf--Cornell)
W80-01612

PLANNING AND IMPLEMENTING THE TAIPEI SEWERAGE SYSTEM,
Taiwan Provincial Government, Taipei. Sewerage Engineering Dept.
W. K. Liu, and C. F. Ouyang.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani & N. C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 399-405, 1978. 1 Fig.

Descriptors: *Sewage systems, *Sewerage, *Long-term planning, *Environmental control, *Water pollution, *Taipei(Taiwan), Industrial wastes, Municipal wastes, Urban development, Construction, Programs, Projects, Waste collection, Treatment facilities, Dissolved oxygen, Biochemical oxygen demand.

Taipei, located on the northern part of Taiwan, comprises Taipei City and other densely-populated satellite towns. As domestic sewage and industrial waste from the area cannot be promptly discharged into the ocean because of the tidal flow, river pollution and environmental sanitation problems have become increasingly serious. In solving the domestic and industrial wasewater problem, the Taipei City government (in implementing the Master Plan Report of Sewerage Planning in the Greater Area and following the direction of actual urban development) has prepared and carried out a six-year construction program to improve the environmental sanitation situation. (Bell-Graf--Cornell)
W80-01646

MONITORING LANDFILLS,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5A.
W80-01731

PETROLEUM CONTAMINATION OF WELLS,
New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 5B.
W80-01737

ATTEMPTS TO REDUCE EUTROPHICATION IN AN ARTIFICIAL BATHING LAKE,
Technische Hochschule, Graz (Austria).
For primary bibliographic entry see Field 5C.
W80-01752

MOBILIZATION OF METALS FROM SEDIMENT BY NTA,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5C.
W80-01762

INITIAL IMPACTS OF EXPERIMENTAL FISH INTRODUCTIONS ON THE MACROZOOPLANKTON OF SMALL OLIGOTROPHIC LAKES,
British Columbia Univ., Vancouver. Faculty of Forestry.
T. G. Northcote, C. J. Walters, and J. M. B. Hume.
In: Proceedings: Congress in Denmark 1977, Part 3, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 2003-2012, 4 Fig, 13 Ref.

Descriptors: *British Columbia, Canada, *Zooplankton, *Population, *Fish establishment, *Daphnia, *Invasion, *Environmetnal effects, *Fisheries, Crustaceans, Lakes, Fish, Biomass, Growth stages, Fish stocking, Competition, Fish diets, Fish food organisms, Predation, Diptera, Oligotrophy.

Cutthroat trout (Salmo clarki) introduced into Lake Eunice and Dolly Varden (Salvelinus malma) introduced into Lake Katherine, two small oligotrophic lakes in British Columbia, Canada, in 1974-1976, had caused major predation changes but had relatively little effect on crustacean species composition and seasonal abundance. Cutthroat trout and Dolly Varden size increased greatly in formerly fishless lakes compared to donor lakes; some more than tripled their weight by the first summer. However, third and fourth instars of two Chaoborus larval species, C. americanus and C. Trivattatus, were drastically reduced. Some individual fish stomachs contained nearly 1000 fourth instar larvae. Crustacean macrozooplankton total numbers were surprisingly similar between the control and two previously fishless lakes, before, during and after fish introduction. Of 10 crustacean macrozooplankton species, only two, Daphnia rosea and Diaptomus kenai, decreased considerably in 1975 and 1976 lakes with fish introduced. Bosmina longirostris varies in response; Lake Eunice numbers were lower in years following fish introduction. D. kenai bodysize decreased sharply in 1975 and 1976 compared with 1974. In contrast, average Bosmina size is significantly larger in fish introduced lakes in 1975-1976 than in previous years. However, fish predation might not directly cause body size changes. Chaoborus removal by fish may result in decreased juvenile D. kenai mortality and thus higher abundance and lower individual growth rates and adult body sizes. (Danovich-Wisconsin)
W80-01767

APPLICATION OF STREAM ECOLOGY TO RAISING SALMON SMOLTS IN HIGH DENSITY,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
J. H. Mundi, and D. E. Mounce.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 2013-2018, 1 Fig, 3 Tab.

Descriptors: *Salmon, *Smolt, *Big Qualicum River(Canada), *Growth rates, *Fish farming, *Fish diets, Salmonids, Marine fish, Commercial fish, Vancouver(Canada), British Columbia, Fish food organisms, Fish management, Fish hatcheries, Rivers, Nutrients, Nutrient requirements, Invertebrates, Food habitats, Growth stages, Fry, Mortality, Fish populations, Fisheries, *Canada.

Fundamental stream characteristics can be useful as strategies for rearing coho salmon (oncorhynchus kisutch) in high density during their freshwater stage. A channel excavated alongside Big Qualicum River, Vancouver Island, British Columbia, employed a riffle/pool sequence at a meander for rearing coho smolts. The fast-flowing riffle produces zoobenthos food and transports invertebrate drift; the pool provides habitat where fish eat incoming drift; and the undercut bank provides cover or shade. Big Qualicum experimental rearing channel is 396.2 m long and 4.57 m wide; riffle depth is 15 cm and pool depth is 0.9 m. Commercial moist mash and pellets were offered to small fry at 75% hatchery rations. Fry samples in June and September during the first year show 65% with natural food at upstream channel areas and 91% at downstreams areas. Downstream has lower fry density and greater invertebrate enrichment. Most common invertebrates in the pools and riffles are Orthocladiinae, Tanytarsini, Chironomini, and Oligochaeta. Riffle food production buffers any inconsistencies in commercial diets, reduces costs, and lets fish acquire natural feeding modes by pursuing moving prey, thus assisting adaptation to estuarine life. In the following February, fry were clipped and tagged. Mortalities amounted to 37% since stocking; 15% were due to dead or weak fish removed from screens, the remaining losses were attributed to predation by mammals such as mink, and birds such as the great blue heron, common merganser, and belted kingfisher. (Danovich-Wisconsin)
W80-01768

ON THE REOXYGENATION EFFICIENCY OF DIFFUSED AIR AERATION,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hydromechanik.
M. Markofsky.
Progress in Water Technology, Vol 11, No 3, p 59-71, 1979. 10 Fig, 4 Tab, 9 Ref.

Descriptors: *Oxygenation, *Dissolved oxygen, *Aeration, *Diffusion, Oxygen, Air, Mixing, Laboratory tests, Bubbles, Water pollution, Water quality, Water quality control, Reaeration, Water treatment, Bubble curtains.

One technique used to increase the dissolved oxygen concentration of polluted waters is the bubbling of air through a diffuser pipe located at depth, thereby producing a bubble curtain from which oxygen transfer to the water occurs. The results of laboratory studies on the aeration efficiency of a diffuser placed along the entire width of a flume, perpendicular to a cross flow, were presented (two dimensional aeration). Parameters investigated included (1) diffuser type--porous materials with mean pore sizes of 40 micrometers, 90 micrometers and 180 micrometers and perforated pipes with 0.4, 0.6, and 1.0 mm diameter ports, (2) air flow rate per unit width (3-53 cu m/mxh), and (3) cross flow velocity (2.5-15 cm/s). The effect of variation from the two dimensional situation was also discussed as well as the consequence of using oxygen instead of air, the sensitivity to discharge angle, port spacing, and the free surface. The measured efficiencies were compared with theory as well as available laboratory and field data. The major conclusions were (1) Aeration efficiencies using diffused air aeration are on the order of 2-13%/m. (2) The aeration efficiency increases with increasing cross flow velocity and decreasing air flow rate per unit width. (3) Aeration efficiencies using porous filters, for air flow rates less than 40 cu m/mxh, are significantly higher (a factor of 2-3) than those achieved using perforated pipes. (4) Changing the pore size from 40 micrometers to 180 micrometers, the port size from 0.4 to 1.0 mm, or the port spacing does not significantly affect the

aeration efficiency. (5) Aeration using oxygen is somewhat less efficient than that using air. However, since equivalent oxygen bubbles contain approximately 5 times more oxygen than air bubbles, more oxygen is transferred on an absolute basis at the same gas flow rate using compressed oxygen as opposed to air. (6) Aeration efficiency resulting from aeration over a portion of the entire width can be reasonably predicted using the results of the two dimensional studies. (7) The available laboratory and field data compare well with results of these laboratory studies. (Sims-ISWS)
W80-01846

RUNOFF CONTROL COMPARISONS FOR COMMERCIAL BEEF CATTLE FEEDLOTS,
Science and Education Administration, Lincoln, NE.
C. B. Gilbertson, J. A. Nienaber, J. L. Gartung, J. R. Ellis, and W. E. Splinter.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 842-846, 849, July-August 1979. 1 Fig, 6 Tab, 21 Ref. EPA S802197.

Descriptors: *Feed lots, *Runoff, *Water quality control, *Farm wastes, *Nebraska, Control systems, Ponds, Settling basins, Sewage treatment, Soil disposal fields, Waste disposal, Waste water disposal, Livestock, Agriculture.

A runoff control system was installed under EPA sponsorship on the L.P. Schram Feedlot, Papillion, Nebraska, to determine runoff characteristics from a large feedlot, and the adequacy of current runoff control system design criteria. System components were sediment basins, conveyance channels, holding ponds, and a disposal system. The quantity of runoff during this study was 73% of that reported for small feedlots. However, about 30% below normal annual precipitation and relatively light snowmelt explain this discrepancy. The total solids content of the holding pond was 25% below that of published values. All values for total and volatile solids, electric conductivity, pH, nitrogen, phosphorus, and COD were within published ranges. Recommendations were made for the design of feedlot runoff control systems. (Sims-ISWS)
W80-01851

SIZING COMPONENTS ON OPEN FEEDLOT RUNOFF-CONTROL SYSTEMS,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
J. A. Anschutz, J. K. Koelliker, J. J. Zovne, T. A. Bean, and M. J. Peterson.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 4, p 803-808, July-August 1979. 3 Fig, 8 Tab, 15 Ref.

Descriptors: *Feed lots, *Runoff, *Water pollution control, *Model studies, Mathematical models, Farm wastes, Livestock, Climatology, Evaporation, Precipitation(Atmospheric), Rainfall, Moisture deficit, Ponds, Storage, Agriculture, Feed lot runoff.

A computer-simulation model for open feedlot runoff control systems was used to develop a data base of important climatic variables that can affect the performance of systems. Moisture deficit was found to be most important for irrigation-disposal systems; the ratio of precipitation to evaporation was most important for evaporation systems. A method to size components of feedlot runoff control systems for any specific location was presented, along with necessary coefficients for the method. Variables included were location, soils, crops, disposal area, disposal rate, retention pond depth, disposal management, and percent of runoff controlled. (Sims-ISWS)
W80-01855

REMOVAL OF SILICA FROM MIXED BED DEMINERALIZER,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
For primary bibliographic entry see Field 5F.
W80-01936

PHOSPHATE BAN LOWERS REMOVAL COSTS,
Escanaba Wasterwater Treatment Plant, MI.
For primary bibliographic entry see Field 6C.
W80-01971

AUTOMATIC WATER/SEWER SAMPLER,
For primary bibliographic entry see Field 5A.
W80-01992

WATER CONDITIONS IN THE STOCKHOLM ARCHIPELAGO AFTER THE INTRODUCTION OF BIOLOGICAL AND CHEMICAL PURIFICATION OF WASTE WATER,
Stockholm Water and Sewerage Works (Sweden).
For primary bibliographic entry see Field 5C.
W80-01994

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

COMPUTER ALGORITHMS FOR ASSESSING REGIONAL RIVER RECREATION RESOURCES,
OKalhoma State Univ., Stillwater. Dept. of Geography; and Oklahoma Water Resources Research Inst., Stillwater.
R. D. Hecock, S. W. Tweedie, and J. F. Rooney, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116635, price codes: A06 in papercopy, A01 in microfiche. Report, March 1979, 114 p. 8 Fig, 13 Tab, 4 Append. OWRT B-035-OKLA(1), 14-34-0001-7180.

Descriptors: Rivers, *Recreation demand, *REcreation facilities, Computer models, Computer programs, Regional analysis, Central U.S., Bibliographies, Reviews, *River recreation resources.

The research addressees the following objectives: modification of existing computer program, testing of the program in Oklahoma, and evaluation of the capabilities of the system. The following procedures were undertaken: RECSAD II was developed; parameters of river use were obtained; simulations were performed under different assumptions of river use levels; river use data were compared with simulated values; the project was assessed. Accurate prediction of recreation travel for rivers was not obtained. Insights into the problems of modeling river recreation travel are discussed. Programs for assessing and describing travel patterns are presented.
W80-01602

PREVENTIVE CONTROL OF WATER POLLUTION IN DEVELOPING COUNTRIES,
Ahmadu-Bello Univ., Zaria (Nigeria). Dept. of Civil Engineering.
B. Z. Diamant.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, Feb. 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh, Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 9-15, 1978. 1 Ref.

Descriptors: *Water pollution control, *Prevention, *Developing countries, Management, Decision making, Legislation, Industrialization, Pollution sources, Training.

The different factors affecting water pollution control in developing countries are briefly reviewed. The differences in management decision making processes in developed and developing countries are compared and implications are discussed. Covered herein are pollution sources, industrialization, legislation, and training. It is apparent that a distinct approach must be promulgated for developing countries. (Bell-Graf--Cornell)
W80-01609

INTEGRATED POLLUTION CONTROL -- A MODEL FOR DEVELOPING COUNTRIES,
Shri Govindram Seksaria Technological Inst., Indore (India).
M. V. Ranganath, and T. A. Sihorwala.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc., in USA), p 85-91, 1978. 8 Tab, 3 Ref.

Descriptors: *Pollution abatement, *Mathematical models, *Developing countries, *India, Water policy, Planning, Industries, Air pollution, Water pollution, Sewage, Effluents, Costs, Treatment, Damage index, Data analysis, Systems analysis.

The Government of India passed the Water Pollution Act in 1974. This paper analyzes a macro model of water pollution control in Madhya Pradesh State in India. The analysis shows that developing countries should adopt short-term and long-term policies. In Madhya Pradesh, pollution in selected industries reduces the water pollution by more than 80%. Similar results are true for air pollution as well. Proper composting of garbage reduces air pollution and indirect water pollution and also produces much needed fertilizer. As a long-term policy, it may be necessary to introduce the Sewerage System and permit industries to connect their effluents after preliminary treatment. (Bell-Graf--Cornell)
W80-01616

A SYSTEMS APPROACH TO WATER QUALITY CONTROL: SG. S. KIRI, MALAYSIA AS A CASE STUDY,
Singapore Univ. Dept. of Civil Engineering.
K. K. Chin.
In: Water pollution Control in Developing Countries. Proceedings of the International Conference hlad at Bangkok, Thailand, February 1987. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology Bangkok, Thailand (Pergamon Press Inc. in USA), p 103-110, 1978. 4 Fig, 3 Tab, 5 Equ, 4 Ref.

Descriptors: *Water quality control, *Systems analysis, *Optimization, *Flow *Cost minimization, *Sungeli S. Kiri river(Malaysia), *Simulation analysis, Industrial wastes, Measurement, Mathematical models, Equations, Dissolved oxygen, Biochemical oxygen demand, Constraints, Water treatment, River basins, Environmental control, Generalized Reduced Gradient method.

The Sungei (river) S. Kiri in Malaysia has experienced pollution problems as a result of industrial discharges and peat field runoff. The organic substances from palm oil waste discharge completely depleted the dissolved oxygen in the upstream section during low flow conditions. The oxidation of sulfide runoff from peat fields not only depleted the DO but also lowered the pH of the water and increased its iron and sulfate contents. To clean up the river, waste discharge and surface runoff would have to be controlled. This paper outlines the problem and proposes a systems approach for its solution. The Generalized Reduced Gradient method is used to derive optimal flows and annual least-cost abatement. The systems approach to management of the river basin must involve complete analysis of water quality models and environmental control procedures, taking into consideration various water use patterns, water quality criteria, and waste inputs. (Bell-Graf-Cornell)
W80-01618

CHLORINATION SYSTEM ANALYSIS,
College of Engineering, Suraboya (Indonesia).
P. M. Berthouex.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani & N.C. Thanh. Institute of Technology, Bangkok, Thailand (Pergamon Press in USA), p 597-606, 1978. 6 Fig, 2 Tab, 12 Equ, 12 Ref.

Descriptors: *Chlorination, *Water treatment, *Systems analysis, *Optimization, *Cost minimization, Estimating, Kinectics, Design, Mathematical models, Equations, Sensitivity, Inflation, Developing countries.

A minimal cost pollution control system or process must be well designed and properly operated. This paper considers the design of a process that requires addition of an expensive material that changes in cost as energy supplies and costs change. The objective is to show how construction costs can be traded against operating costs, how increases in process loading can be handled in the analysis, and how inflation of the operating costs influence decision making. The example used is chlorination system design, as it involves many design concepts and yet is simple enough that the modeling does not obscure decision making. (Bell-Graf--Cornell)
W80-01662

WATER SUPPLY PLANNING MODEL FOR WEST AFRICA,
Thayer School of Engineering, Hanover, NH.
P. H. Kirshen.
Journal of the Water Resources Planning and Management Division, Proceedings of the American society of Civil Engineers, Vol 105, No WR2, p 413-427, September 1979. 2 Fig, 3 Tab, 17 Equ, 8 Ref.

Descriptors: *Water resources, *Optimization, *Planning, *Africa, *Arid lands, Water supply, Mathematical models, Systems analysis, Mixed-integer programming, Regional analysis, Benefit maximization, Cost minimization, Water demand, Decision making, Constraints, Equations, Hydrology, Groundwater, Surface waters, Annual, Seasonal.

A mixed integer programming (MIP) optimization model is formulated for use in the arid, underdeveloped Sahel-Sudan region of West Africa. Its purpose is to determine either the least-cost set of sources to meet fixed demands or the sources and water uses that maximize the net benefits of water use. Since for planning purposes the model is designed to apply to the entire region and some subareas have only small-scale development options, both large and small scale development of a wide variety of demands and supplies are modeled. The function can be expressed either as the minimization of supply costs or as the maximization of the net benefits of water use. The major constraints are that in each planning subarea and in each season hydrologic continuity must exist, and demand must be met. The major devision variables are the capacities of supply sources, and in the net benefit maximization case the water demand quantities. MIP is used to model the possibility of different reservoir operating at a site. (Bell-Graf--Cornell)
W80-01678

EVALUATION OF ALTENATIVE STORM-WATER DETENTION POLICIES,
Pirnie (Malcolm) Inc., White Plains, NY.
G. E. Kamedulski, and R. H. Mc Cuen.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR2, p 171-186, September 1979. 1 Fig, 8 Tab, 20 Equ, 6 Ref.

Descriptors: *Water policy, *Alternative planning, *Storm water, *Detention basins, *Simulation analysis, *Model studies, *Runoff, *Sediments, Evaluation, Optimization, Design, Equations, Watersheds(Basins), Drainage, Erosion, Flood control, Flood frequency, Hydrology, Water management(Applied), Reservoirs, Systems analysis.

Mathematical modeling has been found to be a quick, inexpensive and effective means of evaluating existing stormwater detention policies and examining alternative policies. A stormwater model was calibrated with data collected from a watershed located in Montgomery County, MD. The data base included measured precipitation and both sediment and flow into and from the detention basin. Model studies have indicated that many existing SWM policies do not meet the intent of SWM because they ignore the volume-duratin frequency concept tha has long been used in hydrologic design. SEM policies often fail to specify a duration for detention basin design and limit the design frequency to a single return period. A detention basin that is designed using a policy based on a single return period will not limit the entire flood frequency curve to that of the before-development conditions, and thus the policies do not satisfy the intent of a SWM. Also, less costly designs are possible if both basin volume and outlet characteristics are considered simultaneously. (Bell-Graf--Cornell)
W80-01689

INTEGRATED DEVELOPMENT OF RIVER BASINS OVERVIEW AND PERSPECTIVES,
National Water Authority, Budapest (Hungary).
I. Degen.
In: River Basin Development: Policies and Planning. Volume 1. Proceedings of the United Nations Interregional Seminar on 'River Basin and Interbasin Development,' Budapest, Hungary, September 1979. In cooperation with the UN development Programme and the National Water Authority of Hungary. p 3-19, 1976. 2 Fig, 2 Map, 68 Ref.

Descriptors: *River basin development, *Planning, *Water resources, *Water policy, Economics, Environment, Social aspects, Management, Evaluation, Systems analysis, Decision making, Optimum development plans, Analytical techniques, Objectives, Achievement, Integrated approach.

In modern times, all aspects of the multilateral relationship between socio-economic development and the natural environment are closely related to water conditions. Therefore, river basin development designed to manage water resources on a basin-wide scale has become one of the decisive factors in the evolutions of socio-economic advancement. Former isolated projects of local significance have been replaced by technically, economically superior water systems developed gradually and operated in coordination. In order to determine the proper development option in which limited economic and natural resources can be developed to the greatest benefit, the integrated approach to river basin development is called upon, which is realized substantially by attempting to include the largest possible number of effects into the sphere of decisions related to the development objectives. The exact identification and evaluation of development objectives and effects are fundamental prerequisites. Multiobjective decision theory should be applied along with systems analysis in order to evaluate achievement; special emphasis should be placed on the social and environmental aspects of river basin development, followed by an ex-post evaluation of river basin projects and the interbasin transfer of water resources. The application of advanced decision analysis methods does not exempt the decision maker and planner from making individual or collective judgement nor from checking conclusions against experience. (Bell-Graf--Cornell)
W80-01693

RIVER BASIN DEVELOPMENT FOR SOCIO-ECONOMIC GROWTH GENERAL REPORT,
National Water Authority, Budapest (Hungary).
L. David.
In: River Basin Development: Policies and Planning. Vol 1. Proceedings of the United National Interregional Seminar on 'River Basin and Interbasin Development,' Budapest, Hungary, September 1979. In cooperation with the UN Development Programme and the National Water Authority of Hungary. p 25-37, 1976. 2 Fig, 7 Equ, 41 Ref.

Descriptors: *River basin development, *Socio-economic growth, *Comprehensive planning, *Systems analysis, *Water resources, Estimating, Equations, Optimum development plans, Long-term planning.

The objective of this general report is to analyze the inseparable link between socio-economic growth and river basin development considering the latter to be a subsystem of the former. To achieve this objective, the concept of comprehensive river basin development is discussed, its systems analysis is presented, and on this basis, some of the main conditions and means of reasonable implementation of river basin development are determined. The paper lists conclusions and proposals to be used as a basis for the findings and recommendations of the seminar. The purpose of river basin development is to achieve the optimum use of natural water resources on a basin-wide scale during socio-economic growth. Comprehensive river basin development which has three evolutionary periods, must be a planned complex and interdisciplinary process controlled on a systems analysis basin. The main components of river basin development systems can be divided into four groups: components of socio-economic development; socio-economic needs for river basin development; resources needed for river basin development; and engineering activities. The system can be built up on the basis of these components and their relations. (Bell-Graf--Cornell)
W80-01694

AGRICULTURAL ENERGY MODELING: DISCUSSION OF LINEAR PROGRAMMING MODELS,
Minnesota Univ., Minneapolis; and Minnesota Univ., St. Paul.
V. R. Eidman.
American Journal of Agricultural Economics, Vol 60, No 2, p 1081-1082, May 1978. 3 Ref.

Descriptors: *Agriculure, *Energy, *Model studies, Simulation analysis, Linear programming, Optimization, Alternative planning, Regional analysis, Economic impact, Water resources, Land resources, Systems analysis.

This short article discusses problems in the aggregate use of simulation and inter-regional programming optimization models that simultaneously select production systems for alternative regions. There is a need for detailed analyses of crop enterprise production systems at the firm level. The models should consider embodied energy when evaluating alternative technologies. Finally, an area needing study is the evaluation of changes in institutional arrangements to encourage energy efficiency. (Janet Bell-Graf)
W80-01698

UTILIZATION OF DISSOLVED ORGANIC CARBON BY HETEROTROPHIC BACTERIA AND PROTOZOA,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
For primary bibliographic entry see Field 6G.
W80-01797

COMPUTER MODELING FOR THE LAKE TAHOE BASIN: IMPACTS OF EXTREME LAND-USE POLICIES ON KEY ENVIRONMENTAL VARIABLES,
California Univ., Davis.
B. A. Sloane, and T. E. Dickinson.
Journal of Environmental Systems, Vol 9, No 1, p 39-56, 1979. 1 Fig, 6 Tab, 15 Ref.

Descriptors: *Lake Tahoe(CA/NV), *Computer models, *Land use, *Alternative planning, *Regional economics, California, Nevada, Model studies, Population, Tourism, Employment, Water quality, Environmental effects, Planning, Public participation, Zoning, Social aspects, Industrialization, Housing, Economic impact, Construction.

A socio-economic computer simulation model of population, growth and land-use in the Lake Tahoe Basin utilizes the best available statistical data and incorporates views of regional planners and interested citizens. The model compares broad long-range social and economic implications of potential governmental policies. Major variables or submodels are: available jobs; locally employed seasonal residents; housing demand; housing supply; housing market reconciliation; basin acreage; year-round residents employment status; business units; year round residents' age structure;

tourist visitor days; tourist amenities; and special factors. Computer simulation runs were made of seven extreme land-use policy packages which included the following policies: (1) construction and subdivision moratorium; (2) housing occupancy limitation, (3) removal of most campground and commercial limitations; (4) increase in number of residential units per acre; (5) additional acres zoned residential; (6) doubling of gambling casino facilities; and (7) new light industry. Each policy package was simulated using three different model versions to accomodate its high sensitivity to assumptions about tourism. Results show that the number of acres developed and the related lake water clarity reduction would be greater with upzoning policies such as density variances than with simulatory ones such as new industry promotion. (Luedtke-Wisconsin)
W80-01963

ECOLOGY AND ECONOMICS IN LAGOS STATE,
Ibadan Univ. (Nigeria). Dept. of Geography.
O. Areola, and A. Faniran.
The Nigerian Journal of Economic and Social Studies, Vol 17, No 1, p 63-76, March 1975. 1 Fig, 11 Ref.

Descriptors: *Land resources, *Lagos State, Nigeria, *Land use, *State jurisdiction, *Land management, *Adoption of practices, Nigeria, Africa, Land classification, Land development, Regional economics, Governments, Jurisdiction, Regulation, Land ownership, Data collections, Social aspects, Plainning, River basin development..

Rational uses of land resources for economic development within constraints of environmental conservation requirements and government planning efforts are discussed for Lagos State, Nigeria. Ths state is small, with vast stretches of swamp and river floodplain; but population density has greatly increased due to in-migration around metropolitan Lagos, the national capital. Land therefore is scarce and careful planning is needed to balance private land use rights with conservation needs. However, there are few codified laws relating to land resources and owners have exclusivity of rights even over streams running through their properties. As an initial step, the state government might assume rights of control over sparcely settled lands such as coastal barrier ridges, flat sandy plains, swamps and river floodplains. In densely settled areas, government land use controls could be exercised through such means as selective siting of industrial estates and planned growth for urban service centers. However, no effective planning can be started without first completing a comprehensive survey of all land resources in the state. Three options are given to improve data collection for such a survey: (1) create a Federal coordinating body for data collection, analysis, and storage, possibly in the Ministry of Economic Developmet; (2) create an independent data collection body on an inter-agency basis; (3) create separate data banks for each state government. (Harris-Wisconsin)
W80-01966

CURRENT USE OF WATER SURFACE ZONING FOR RECREATION,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Natural Resources.
T. L. Brown, E. J. Finegan, and M. P. Voiland.
Water Resources Bulletin, Vol 15, No 2, p 337-344, April 1979. 6 Ref.

Descriptors: *Recreation demand, *Water zoning, *Competing uses, *Regulation, *State governments, *Local governments, Zoning, Recreation, Non-structural alternatives, Boating, Swimming, Fishing, Water skiing, Water quality control, Planning.

Water surface zoning methods are increasingly used to provide safe, equitable recreation opportunities as well as a water quality protection among competing uses. Zoning techniques employed by state and local governments in 1976-1977 can be organized into five broad categories: (1) restrictions on boat speed and horsepower; (2) special use zoning which limits or prohibits specific activities; (3) time zoning, which confines activities to certain times of the day or between certain dates; (4) protective space zoning, which separates incompatible activities; and (5) limited density zoning which restricts the number of recreation participants. States which frequently use water surface zoning find it effective regardless of types or means of implementation. However, for successful utilization, a number of conditions must be met: (1) In cases where the shore is not entirely under state jurisdiction, local input and concurrence are required. (2) Regulations must be consistent with other state laws. (3) Regulations must be well publicized and posted. (4) Regulations must be enforceable. Zoning techniques have been used on inland waters of limited size which have high multi-use recreation demand. (Luedtke-Wisconsin)
W80-01973

6B. Evaluation Process

COMPUTER ALGORITHMS FOR ASSESSING REGIONAL RIVER RECREATION RESOURCES,
OKalhoma State Univ., Stillwater. Dept. of Geography; and Oklahoma Water Resources Research Inst., Stillwater
For primary bibliographic entry see Field 6A.
W80-01602

ARTIFICIAL WETLANDS: VALUES, REGULATORY, AND DEVELOPMENTAL ISSUES,
Rhode Island School of Design, Providence. Div. of Architectural Studies.
J. E. Lukens, and J. M. Everett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-115934, Price codes: A02 in papercopy, A01 in microfiche. Rhode Island Water Resources Center, University of Rhode Island, Kingston, Project Completion Report 1978. 12 p. OWRT A-066-RI(1), 14-34-0001-7084.

Descriptors: *New England, *Evaluation, *Artificial wetlands, Natural wetlands, Value, Recreation, Water supply, Flood control, Sediment control.

Artificial wetlands were compared to natural wetlands in four towns in southern New England to determine their relative scenic, open space, and recreation values (the latter being primarily a function of wildlife habitat). The results showed that unmanaged artificial wetlands assume values within a few years that are virtually undistinguishable from the values of natural wetlands. The historical effects of wetlands upon settlement patterns were examined, with the conclusion that for the most part they have acted to contain and guide growth in a beneficial manner, and this can be expected to continue in the future under state wetland acts. However some situations may be expected to occur whereby the wetland filling would be desirable, provided the values lost can be recreated in artificial situations. It is suggested that the wetlands acts be modified to encourage both this procedure and the necessarily concomitant process of assessing relative wetland values.
W80-01603

WATER POLLUTION CONTROL--SOME LATIN AMERICAN APPROACHES,
Pan American Health Organization, Lima (Peru).
W. A. Castagnino.
In: Water pollution Control in Developing Countries. Proceedings of the International Conference held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 17-28, 1978. 6 Fig, 4 Ref.

Descriptors: *Water pollution control, *Water quality, *Latin Ameria, *Developing countries, *Methodology, Constraints, Mathematical models, Standards, Costs, Discount rates, South American, Investment, Pollutants, Alternative planning, Decision making, Optimal solution, Treatment, Pollution loads, Water body response, Objectives.

Reviewed is the evolution of water quality studies and control actions in Latin American countries where the setting of objectives and constratints plus the water body response to the loads are shown to be essential prerequisities. Therefore, a water quality model must be structured with pertinent parameters to find the most appropriate remedial action. Case studies of the Cauca River and Guanabara Bay in South American are presented herein. The inconvenience of adopting 'a priori' standards for developing countries is stressed by showing the incidence in costs caused by high discount rates for initial investments among other aspects. Finally, the paper analyzes the problems to overcome for proper water pollution studies in Latin America. (Bell-Graf--Cornell)
W80-01610

SOME ASPECTS OF WATER POLLUTION CONTROL IN SRI LANKA,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
A. Amirtharajah
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh, Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc., in USA), p 77-82, 1978. 2 Fig, 2 Tab, 1 Equ, 5 Ref.

Descriptors: *Water pollution control, *Programs, *Kelani Ganga River(Sri Lanka), Environmental preservation, Economic growth, Hydrology, Rivers, Industrial development, Water quality, History, Streeter-Phelps equation, Developing countries, Technology, Legislation

The validity of some general principals for an effective water pollution control program in developing countries is illustrated with a case study of the Kelani Ganga in Sri Lanka. By applying some of these principles, economic growth with industrial development can be pragmatically balanced with preservation of the environment. The essential need for legislation, a central authority, and low-cost technology systems is illustrated. (Bell-Graf--Cornell)
W80-01615

IMPLEMENTATION OF WATER POLLUTION CONTROL PROGRAM: A JOINT INDUSTRY-GOVERNMENT APPROACH,
All India Inst. of Hydgiene and Public Health, Calcultta.
K. J. Nath, and A. Dasgupta.
In: Water Pollution Control Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press, Inc., in USA) p 93-101, 1978. 2 Fig, 2 Tab, 3 Ref.

Descriptors: *Water pollution control, *Programs, *Developing countries, *Governments, *Industries, *Constraints, *India, Planning, Effluents, Standards, Water resources, Municipal wastes, Industrial wastes, Technical aspects, Financial aspects, Legiglation, Scheduling

Wate Pollution control on a large scale is gaining momentum in India and in other developing countries. As rapid industrial development has been rather haphazard and uncontrolled, eneven urban and industrial growth has taken place resulting in the discharge of heavy municipal and industrial waste loads on water courses. In India, the Water Pollution Control Act was promulgated in 1974 which established effluent discharge standards and various programs to reduce water pollution have been experimented. However, the progress to data is far from satisfactory. Herein, an attempt has been made to identify the major constratints in evolving a sound water quality management program. The authors also propose a joint industry-government approach for the management of water pollution problems in heavily industrialized urban complexes. The technical and financial aspects of the proposed plan are discused and a definite time table for implementation in a particu-

lar complex in West Bengal state in eastern India is suggested. (Bell-Graf--Cornell)
W80-01617

RIVER, ESTUARY, LAKE AND RESERVOIR QUALITY MANAGEMENT,
Department of Irrigation, Colombo (Sri Lanka).
For primary bibliographic entry see Field 5A.
W80-01624

OPTIMIZATION OF SEWAGE TREATMENT AND FISH PROPAGATION IN PONDS,
Asian Inst. of Tech. Bangkok (Thailand). Div. of Environmental Engineering.
S. Muttamara, and G. Wattayakorn.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February, 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 241-251, 1978. 5 Fig, 7 Tab, 8 Ref.

Descriptors: *Optimization, *Sewage, *Treatment, *Fish propagation, *Ponds, *Developing countries, *Economic analysis, Tropical countries, Economic feasibility, Operating costs, Thailand, Oxidation lagoons.

In tropical countries like Thailand, where the climate is sunny and warm, oxidation ponds have become a popular method of treating domestic waste. The main advantage of this process lies in its low cost of construction and simplicity of operation and maintenance. Besides its high efficiency of BOD removal, it has the added advantage of the possible by-product recovery of algae which is rich in protein content. Oxidation pond effluent can also be used for fish cultivation. Undiluted oxidation pond effluent has been found to be too toxic for fish, because the excessive growth of algae results in the depletion of dissolved oxygen causing fish mortality. Diluted algae pond effluent (33 and 50%) was found to be optimum for fish growth. An economic analysis of the oxidation fish pond system indicated that the operating costs of waste treatment could be markedly reduced or even turned into a profit for the community involved. (Bell-Graf--Cornell)
W80-01633

A BCCIPA MODEL FOR WATER RESOURCE PROJECT EVALUATION,
Midwest Research Inst., Kansas City, MO.
B. C. Liu.
In: Water Pollution Control in Developing Countries. Proceedings of the International Conference, held at Bangkok, Thailand, February 1978. Edited by E.A.R. Ouano, B.N. Lohani and N.C. Thanh. Asian Institute of Technology, Bangkok, Thailand (Pergamon Press Inc. in USA), p 253-259, 1978. 1 Fig, 12 Ref.

Descriptors: *Water resources, *Projects, *Mathematical models, *Cost-benefit analysis, *Economic impact, *Social impact, *Lakes, *Assessment, *Water quality, Water pollution control, Improvement, Decision making, Simulation analysis, Probability, Planning, United States, Systems analysis.

Following the enactment of the Flood Control Act in 1944, a subcommittee on evaluation standards of the Inter-Agency Committee on Water Resources was established in the United States for the purpose of formulating mutually acceptable principles and procedures for determining benefits and costs of water resource projects. In 1973, the Water Resources Council established principles and standards for planning for water and related land resources development, management and utilization. The primary objective of this paper is to develop a Benefit-Cost Cross-Impact Probabilistic Model describing and evaluating some very critical socio-economic impacts related to water resource planning and project management for ultimate improvements in water quality and pollution control in the United States. Discussed is the BCCIPA model for evaluating the effectiveness of lake restoration projects, including direct and indirect impact assessment, as well as induced impact assessment; considered is the model's application and the technical restoration demonstration project. (Bell-Graf--Cornell)
W80-01634

THE IMPORTANCE OF INDUSTRIAL EFFLUENT SURVEYS AND EFFECTS IN THE ECONOMICAL CONTROL OF WATER POLLUTION,
International Consulting and Lab. Services (England).
For primary bibliographic entry see Field 5C.
W80-01637

WATER RESOURCES EDUCATION REQUIREMENTS OF ENGINEERING FIRM,
Harza Engineering Co., Chicago, IL. Water Resources Div.
A. H. Schultz, and R. A. Westmore.
Journal of the Water Resources Planning and Management division, Proceedings of the American society of civil Engineers, Vol 105, No WR2, p 377-384, September 1979.

Descriptors: *Employment, *Consulting engineers, *Engineering education, *Employee relations, *Undergraduate study, Water resources, Water conservation, Land development, Personal attributes, Improvement, Programs.

The overall quality of college-level education in water resources planning and engineering is high, based on the qualifications of recent graduate engineers seeking employment in consulting engineering work. Certain deficiencies in water resouces education background still exist which, if alleviated, would reduce the time spent by consultants for training. The writers, engineers in the Water Resources Division of an international consulting firm specializing in the development of water, land, and power resources, provide a summary of the qualities looked for in hiring recent graduates, highlight specific areas where educational improvement is desirable, and provide suggestions for improving the educational experience to the benefit of both the student and the prospective employer. (Bell-Graf--Cornell)
W80-01680

VOTER REACTION TO MULTIPLE-USE DRAINAGE PROJECTS,
Georgia Inst. of Tech., Atlanta.
T. N. Debo, and J. T. Williams.
Journal of the Water Resources Planning and Management Division, Proceedings, of the American society of Civil Engineers, Vol 105, No WR2, p 295-303, September 1979. 4 Fig, 3 Tab.

Descriptors: *Land use, *Urban development, *Surveys, *Data collections, *Bond issues, *Multiple use, Planning, flood control, Drainage, Urban planning, Public works, Georgia, Projects, Watershed(Basins), Residential areas, Questionnaires.

A survey was conducted to study the reasons why a drainage bond referendum in DeKalb County, Ga. was defeated and the political feasibility of using a multiple-use concept as a replacement. The resuls of the survey confirmed two important points: (1) the more directly people perceive themselves to be affected by a problem, the more likely they are to support a government program to correct that problem; and (2) a significant number of voters will not support a government program they perceive to be poorly planned even though they may support the goals of the program. Both of these points support the concept behind the multiple-use concept, which received much greater support in the survey than the single-purpose concept that was defeated. A summary of survey results is presented to document discussions and conclusions. (Bell-Graf--Cornell)
W80-01683

SALINITY CONTROL PLANNING FRAMEWORK,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
G. V. Skogerboe, W. R. Walker, and R. G. Evans.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR2, p 329-341, September 1979. 5 Fig, 1 Equ, 9 Ref.

Descriptors: *Water plans, *Salinity, *Water management(Applied), *Cost effectiveness, Optimization, Irrigation, Water pollution, Water resources, Planning, Assessment, Agriculture, National goals, Inflow-outflow analysis, Hydro-salinity analysis, Simulation analysis, Mathematical models, Best management practices, Systems analysis.

An accurate assessment of salinity problems in an irrigated area requires detailed knowledge not only of the hydrology, but also of many other unique physical and institutional characteristics of the areas being studied. Even though each area must be evaluated individually, because of the site-specific nature of irrigated agriculture, definite procedures are common to all evaluations. A framework for planning a salinity control program has been developed which can be applied to any individual irrigated valley or to an entire river basin. The salinity control planning framework consists of three phases: (1) identification of salinity problems, utilizing inflow-outflow analysis and hydro-salinity and hydro-salinity analysis; (2) development of best management practices, using soil moisture-chemistry simulation and cost-effectiveness analysis; and (3) implementation of best management practices. The planning steps in each phase are considered herein. (Bell-Graf--Cornell)
W80-01690

OPTIMAL CAPACITY OF MUNICIPAL WATER SUPPLY PUMPS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4A.
W80-01691

TO BUILD OR NOT TO BUILD: A BAYESIAN ANALYSIS,
Arizona Univ., Tucson.
L. Duckstein, R. Krzysztofowicz, and D. Davis.
Journal of Hydrological Sciences, Vol 5, No 1, p 55-68, 1978. 1 Fig, 21 Equ, 10 Ref.

Descriptors: *Bayesian decision analysis, *Hydrology, *Design, *Economics, *Risk, *Uncertainty, *Binomial events, Evaluation, Equations, Probability, MathemAtical models, Rainfall, Drainage, Sensitivity analysis, Optimal devision, Poisson model, Opportunity loss, Non-constant loss function, Model choice.

Demonstrated is the use of Bayesian decision theory in hydrologic design from the following viewpoints: (1) hydrologic decision-making under natural and sample uncertainty; (2) economic evaluation of the worth of perfect information; (3) economic evaluation of the worth of additional sample points; and (4) sensitivity analyses on hydrologic model choice and on economic model choice. This approach is presented by means of a very simple yet realistic example which provides the advantage that close form solutions can be obtained and evaluated numerically by hand. It is concluded that Bayesian decision analysis always leads to a correct decision. Economic uncertainties may be analyzed by Bayesian methods whenever an uncertain economic parameter may be identified. (Bell-Graf--Cornell)
W80-01696

ASSESSMENT OF THE ENVIRONMENTAL INFRASTRUCTURE REQUIRED BY LARGE PUBLIC AND PRIVATE INVESTMENTS,
Harvard Univ., Cambridge, MA. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 5C.
W80-01699

SPACE-CORRELATION FIELDS OF PAN EVAPORIMETER NETWORK,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2D.

W80-01831

MANY USES AND MANY USERS: SOME DESIRABLE CHARACTERISTICS OF A COMMON LAND AND WATER CLASSIFICATION SYSTEM,
Utah State Univ., Logan. Dept. of Forestry and Outdoor Recration.
For primary bibliographic entry see Field 7B.
W80-01898

THE DILEMMA OF STREAM CLASSIFICATION,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 2E.
W80-01899

LAKE CLASSIFICATION--GOOD AND BAD,
Arizona State Univ., Tempe. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W80-01900

CLASSIFICATION OF COASTAL ENVIRONMENTS,
Conservation Foundation, Washington, DC.
J. Clark.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 79-102, 1978. 11 Fig, 1 Tab, 12 Ref.

Descriptors: *Systematics, *Coastal areas, Shores, Dunes, Beaches, Flood plains, Watersheds, Wetlands, Aquatic habitats, Estuarine environment, Bays, Embayments, Lagoons, Topography, Soils, Vegetation, Geology, Hazards, Storms, Flooding, Erosion, Wildlife.

Ecologically comprehensive classification of coastal and marine habitat requires complete understanding of the physical and biological processes involved. The coastal zone is separated into two subsystems: shorelands and coastal waters. The terrestrial coast is regionalized into natural ecosystems types: watershed, flood plain, wetland, shoreland, dune, beachfront, and all ecotones between such areas and the aquatic environment. Coastal waters are subcategorized into estuarine, bay, embayment, lagoon, nearshore and oceanic regimes, including pertinent ecotones. Nine areas are described for comprehensive inventory data collection: topography, soil vegetation, geology, hazard areas, critical habitat, vital areas, hydrology, and wildlife and other valuable resources. Ecosystem management must be done full knowledge of the natural system and its elments. (See also W80-01897) (Otello-Mass)
W80-01901

INSULAR AQUATIC ECOSYSTEMS: HAWAII,
Hawaii Cooperative Fishery Research Unit, Honolulu.
J. A. Maciolek.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 103-121, 1978. 1 Tab, 13 Ref. 2 Append.

Descriptors: *Hawaii, *Ecosystems, *Aquatic environment, *Systematics, *Aquatic life, *Aquatic habitats, Running waters, Lakes, Wetlands, Estuaries, Ponds.

Extensive field studies by the Hawaii Cooperative Fishery Research Unit provided a base for a provisional, functional classification of all Hawaiian surface waters exclusive of the marine ecological system. Traditional physiochemical features and characteristic biota are employed in the designation of 14 ecosystem types comprising 4 flowing water types, 3 lacustrine types, 4 palustrine (wetland) types, 2 estuarine types, and a unique mixohaline coastal ecosystem in recent lava fields--anchialine pools. Eight of the types are freshwater, and 6 are mixohaline; 11 of them are natural and 3 are manmade. Abundance of each type, mostly estimated, is given. Appendix information includes descriptive summaries of environmental features and biota of each ecosystem and thier distributions are shown on maps of the five largest islands. (See also W80-011897) (Otello-Mass)
W80-01902

THE IUCN DIRECTORY OF WETLANDS OF INTERNATIONAL IMPORTANCE,
International Union for Conservation of Nature and Natural Resources. Arles (France).
E. Carp.
In: Classification, inventory, and analysis of fish and wildlife habitat--the proceedings of a national symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 137-144, (1978), 7 ref.

Descriptors: *Wetlands, *Foreign countries, *Systematics, *Conservation, Marshes, Bogs, Rivers, Lakes, Peat, Management, Education, Recreation, Projects, Population.

The IUCN Directory's goal is to identify and obtain recognition of wetlands of international importance. IUCN co-sponsored these three projects with the purpose of evaluating the importance of wetlands: MAR which dealt with the conservation and management of temperature marshes, bogs, and other wetlands; AQUA which deals with the conservation of aquatic habitats and aims to list mainly rivers and lakes selected for their limnological and hydrobiological qualities, and TELMA dealing with the conservation of peat-forming formations. The Directory's set-up includes criteria for the selection of sites and the classification system, a list and map for each country, plus a few paragraphs about the general situation of sites of international importance in that country. The Directory defines a wetland and states criteria for: the selection of wetlands of international importance; a wetland's importance to populations and specis; the selection of representative or unique wetlands; the research, educational, and recreational values of wetlands; the practicality of conservation and management. Classification of wetland types include: open sea shallow waters, sea bays, rivers and flood plains, storage reservoirs, lakes, mires, temporary waters, and artifical ponds. (See also W80-01897) (Otello-Mass)
W80-01903

U. S. FISH AND WILDLIFE SERVICE WETLAND CLASSIFICATION--STATUS, 1977,
Fish and Wildlife Service, Jamestown, ND. Northern Prairie Wildlife Research Center.
L. M. Cowardin.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedins of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-77/76, p 165-172, 1978. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Systematics, *Wetlands, *United States, Lakes, Estuaries, Rivers, Sea water, Dominant organisms.

A progress report on current wetland classification efforts within the U.S. Fish and Wildlife Service is presented along with a justification for the need for a new national wetland classification. The new classification's goals are: sufficient breadth to cover all types of land that have been traditionally called wetlands as well as permanently flooded areas that were sometimes included and sometimes excluded from earlier classifications; hierarchical structure which enables the user to choose the degree of detail appropriate to needs, available knowledge, or feasiblility for inventoris; and incorporate detailed definitions at all levels to insure standardization and uniform application. Problems are discussed. The categories of the new wetland classification are: system, subsystem, class, subclass, and dominance class. Systems include marine, estuarine, lacustrine, riverine, and palustrine. All the systems except palustrine are divided into subsystems: subtidal or intertidal. Below subsystems, wetlands are assigned classes based on appearance by aerial photography. The subclasses include broad-leaved evergreen, needle-leaved evergreen, broad-leaved deciduous forested wetlands. Dominance classes are based on the dominat plant or sedentary animal species of wetland. (See also W80-01897) (Otello-Mass)
W80-01904

A DIGITIZED CLASSIFICATION SYSTEM FOR THE NATURAL VEGETATION OF NORTH AMERICA WITH HIERARCHICAL SUMMARY FOR WORLD ECOSYSTEMS,
Arizona Game and Fish Dept., Phoenix.
D. E. Brown, C. H. Lowe, and C. P. Pase.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 187-220, 1978. 13 Fig, 7 Tab, 41 Ref

Descriptors: *Systematics, *Vegetation, *Ecosystems, *Foreign counries, Computers, Biomes, Biological communities, Biogeography, Climatic zones, Plant groupings, Dominant organisms.

The need for a hierarchical and systematic classification for ecosystems is presented with a proposed classification system based on evolutionary criteria that determine the history, adaptations, structure and composition of plant and animal communities, and that ranks natural vegetation into systematized natural sets. Examples of a digitized computer compatible classification to the 4th (= biome) and 5th (= community) levels of the system are given for Nearctic and adjacent Neotropical North America. (See also W80-01897) (Otello-Mass)
W80-01905

EVALUATION OF HABITAT QUALITY IN WYOMING TROUT STREAMS,
Wyoming Game and Fish Dept., Landers.
N. A. Binns
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 221-242, 1978. 2 Fig, 2 Tab, 7 Ref, 8 Append.

Descriptors: *Wyoming, *Trout, *Stream fisheries, *Cold-water fishing, *Aquatic habitats, *Evaluation, Stream flow, Standing crop, Velocity, Bank stabilization, Fish food organisms, Nitrates, Water temperature.

In response to Federal requirements for non-monetary evaluation of water development projects, a rating system was developed to quantify habitat quality in trout steams in the Rocky Mountains. Twenty-one environmental attributes were measured at 20 study sites in Wyoming and the relationship between attributes and trout standing crop was explored by multiple regression analysis. Ten attributes were significantly related to trout biomass and were used to develop a predictive model of habitat quality, the Habitat Quality Index (HQI). Attributes used in the HQI were: late summer stream flows, annual stream flow variation, stream velocity, cover, stream width, streambank stability, fish food abundance and diversity, nitrate concentration, and maximum summer stream temperataure. (See also W80-01897) (Otello-Mass)
W80-01906

A DATA COMPILATION PROGRAM FOR WETLAND EVALUATION,
Beak Consultants, Inc., Portland, OR
J. K. Dueker, and T. W. Haislip, Jr.
In: Classification, inventory, and analysis of fish and wildlife habitat-the proceedings of a national symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS/-78/76, p 331-350, 1977. 13 Fig, 22 Ref.

Descriptors: *Systems analysis, *Management, *Data collecting, *Data storage and retrieval, *Data processing, *Data transmission, Computers, Computer programs, Wetlands

A compilation was designed to select, organize, and present biological data relevant to wetland evaluation. A test of this program was conducted on a data-rich wetland, the Harney Basin area of Oregon. Then a search for computer data management systems was conducted to meet the National

Wetlands Inventory's needs. The basic proposed data organization divides the biological type into vegetation or animal. Each of these divisions are in turn subdivided into group and species, and measures. (See also W80-01897) (Otello-Mass)
W80-01907

HABITAT SCARCITY, A BASIS FOR ASSIGNING UNIT VALUES FOR ASSESSMENT OF AQUATIC WILDLIFE HABITAT,
Missouri Dept. of Conservation, Jefferson City.
J. P. Fry, and W. L. Pflieger.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a National Symposium, January 24-24, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 491-494, 1978. 3 Ref.

Descriptors: *Evaluation, *Aquatic habitats, *Missouri, Fish, Streams, Systematics.

Current methods, for numerical evaluation of wildlife habitat, measure habitat suitability for selected species, weighted toward those important for uses such as hunting and fishing. Evaluation should address future optional needs as well as identified uses. Security of a species is inversely related to scarcity of its habitat, thus relative scarcity of a habitat type is a measure of the types important for future management options. A system for describing and assessing aquatic habitat in terms of relative scarcity and condition is being developed in Missouri. The fish fauna and a few physical factors will be used to delimit stream habitat types. Index values will be computed for each type based on its abundance and condition. Unit values of degraded habitat could be increased by habitat restoration as an exchange, for unit value losses caused by water resources projects, using habitat scarcity and condition as the primary basis for determining the location and amount of exchange. (See also W80-01897 (Otell0-Mass)
W80-01908

INVENTORY AND DISPLAY OF AQUATIC HABITAT,
Forest Service, Anchorage, AK.
A. W. Collotzi, and D. K. Dunham.
In: Classification, Inventory, and Analysis of Fish and Wildlife Habitat--the Proceedings of a Natural Symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS-78/76, p 533-542, 1978. 1 Fig, 3 Tab, 7 Ref.

Descriptors: *Aquatic habitats, *Census, *Systematics, *Streams, Ponds, Depth, Plants, Velocity, Streambeds, Banks, Riparian plants, Stability, Soil classification, Slopes.

A systematic and uniform approach to the inventory and display of aquatic habitat has been developed in the Intermountain Region of the U.S. Forest Service. A line transect method constitutes the inventory of aquatic habitat by measuring habitat variables that are grouped into three habitat categories: water surface, streambottom, and streambanks. A rating score for stream habitat variables is displayed for interpretation and analysis based on pool measure, pool structure, stream bottom, and stream environment. A land classification system for the valley bottom lands provides for the display of the aquatic resource at various levels of planning, and for the interaction of all resources within the valley bottom. This classification consists of four hierarchical levels: subsection, valley bottom association, valley bottom type, and valley bottom phase--the association level being the most important. (See also W80-01897) (Otello-Mass)
W80-01909

A MODELING APPROACH TO EVALUATE TIDAL WETLANDS,
Gruman Ecosystems Corp., Bethpage, NY.
For primary bibliographic entry see Field 2L.
W80-01927

COASTAL WETLANDS VALUE STUDY IN MICHIGAN: PHASE I AND II,
Eastern Michigan Univ., Ypsilanti. Dept. of Geography and Geology.
E. Jaworski, C. N. Raphael, D. L. Tilton, R. H. Kadlec, and B. R. Schwegler.
Report prepared for Michigan Department of Natural Resources, Division of Land Resource Programs, 1978. Phase I, 209 p. Phase II, 98 p.

Descriptors: *Wetlands, *Michigan, *Reviews, *Economics, *Productivity, Coastal marshes, Value, Wildlife habitat, Fish habitat, History, Cycling nutrients, Hydrology.

Phase I research consisted of a literature review of available source materials concerning wetlands values, analysis of data by geographic area, and map comparisons to document the historical loss of depicted coastal wetland vegetation. Phase II, also a literature review, addresses the values and characteristics of coastal wetlands for soils, sedimentation, energy flow, primary productivity, invertebrate and forage fish production, nutrient cycling, hydrology, and an economic analysis of some of these functions. (Steiner-Mass)
W80-01930

CASE STUDY OF THE DEMAND/SUPPLY RELATIONSHIP FOR THE INDUS RIVER BASIN,
National Engineering Service, Lahore (Pakistan).
S. M. H. Bokhari.
Water Supply and Management, Vol 3, No 2, p 77-115, 1979. 6 Fig, 16 Tab, 18 Ref.

Descriptors: *Water supply, *Water demand, *Water supply development, *River basin development, *Regional economics, *Water resources development, Planning, Social aspects, Economic impact, Indus River Basin, Water conservation, Inter-Basin transfers, Linings, Multiple-purpose projects, Water storage.

The relationship between the water supply and demand of the Indus River Basin, one of the major river basins in the Indo-Pakistan subcontinent, has not previously been established in either physical or financial terms. Although a comprehensive inventory of the basin's surface, ground and natural precipitation water is presented here, water resource development in the Indus Basin has not taken place in an integrated manner and adequate data and methodologies are not available in any standard form for aggregation of total water demand in the public or private sectors. No correlation has or can then, be established with certainty between water supply and actual demand for the present, although an empirical relation is derived here based upon a number of assumptions regarding technical and socio-economic conditions. A number of policy options for water resource developments within the basin are suggested, including conservation, lining of canals, precise land levelling, inter-basin transfers, construction of off-channel storage, population redistribution, and a shift in planning to multipurpose water projects. (Tickes-Arizona)
W80-01956

PROCEDURES IN ESTIMATING BENEFITS OF WATER QUALITY CHANGE,
Wisconsin Univ.-Madison. Div. of Natural Resources Economics.
N. W. Bouwes, and R. Schneider.
American Journal of Agricultural Economics, Vol 61, No 3, p 635-639, August 1979. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Benefits, *Water quality control, *Methodology, *Project feasibility, Cost-benefit analysis, Model studies, Lakes, Costs, Theoretical analysis, Water users, Water quality, Pike Lake(WI).

A method for estimating whether benefits derived from preserving a current high level of water quality can justify costs is addressed by: (1) describing the theoretical basis for the empirical analysis; (2) establishing the relationship between an objective measurement of water quality utilized by water resource experts and the subjective ratings of lake users; (3) presenting a model which includes recreation users' ratings of water quality; and (4) synthesizing these components and applying them to a hypothetical decision making situation. In the hypothetical example, the water quality in Pike Lake, Wisconsin is rapidly deteriorating due to large nutrient loads from storm sewers which empty directly into the lake. This decline can be prevented by construction of a storm sewer diversion at a fixed cost of $175,000. Using the developed methodology the current resource value, the impact on users' perceptions of the potential decline in water quality, and the decline in resource value that would be avoided, are determined. Assuming a 20 year period and 10% discount rate, the benefit is shown to be $331,740 well over the expected cost of the Project. (Luedtke-Wisconsin)
W80-01960

INVESTMENT SEQUENCING AND ALLOCATION DECISIONS IN WATER RESOURCE SYSTEM DESIGN: A NOTE ON AN ALTERNATIVE ALGORITHM,
Texas Univ. at Austin. Center for Cybernetic Studies.
R. D. Armstrong, and C. E. Willis.
Water Resources Research, Vol 15, No 5, p 1273-1274, October 1979. 9 Ref.

Descriptors: *Algorithms, *Water allocation(Policy), *Investment, Planning, Mathematical models, Computer models, Optimization, Computer programs, Decision making.

An algorithm to handle computational problems of large scale mathematical models required for simultaneous consideration of water investment planning and water allocation decision is presented. Rausser and Willis (1976) developed an empirical application which incorporated investment sequencing with allocation components. However, no computer program was available which could handle a nonlinear ojective function with mixed-integer variables, and they used an iterative decomposition procedure to permit the two components to interact. This iterative procedure resulted in convergence to a local optimum, but could not guarantee global optimality without listing all possible investment alternatives. The algorithm described is a generalization of the decomposition method of Benders for linear mixed-integer programming problems. It solves the Rausser and Willis problem, converging to the optimal solution, and requires less computer time. (Luedtke-Wisconsin)
W80-01961

DIAGRAMMATIC REPRESENTATION OF THE EXPLOITATION OF REPLENISHABLE NATURAL RESOURCES: DYNAMIC ITERATIONS,
York Univ., Downsview (Ontario). Dept. of Economics.
C. Plourde.
Journal of Environmental Economics and Management, Vol 6, No 2, p 119-126, 1979. 5 Fig, 26 Ref.

Descriptors: *Fish harvest, *Model studies, *Graphical analysis, Renewable resources, Planning, Costs, Risks, Curves, Theoretical analysis, Optimization, Resources development, Development, Management, Consumption, Exploitation.

Geometric representations of two dynamic models of replenishable natural resources harvesting are illustrated. The first is a simple case in which a natural resource product, fish, is extracted without cost in terms of effort or expenditure of capital from a biomass of resource stock. Diagrams are used to illustrate long and short-run tradeoffs between present consumption and future stocks. The evolution of this resource stock is traced from any initial state to an optimal long-run steady state. Discounting and uncertainty are also considered. The second model uses a four-quadrant diagram to show a transition similar to the first when there are production costs such as labor. This adds another good to the model and makes the geometry much more elaborate. The four-quadrant diagram illustrates a short-run equilibrium and the dynamics that lead to a long-run solution on the bionomic transformation curve. (Luedtke-Wisconsin)

W80-01964

ECONOMIC VALUE OF FISH, WILDLIFE, AND RECREATION IN MICHIGAN'S COASTAL WETLANDS,
Eastern Michigan Univ., Ypsilanti. Dept. of Geography.
C. N. Raphael, and E. Jaworski.
Coastal Zone Management Journal, Vol 5, No 3, p 181-194, 1979. 5 Tab, 28 Ref.

Descriptors: *Wetlands, *Value, *Economics, *Sport fishing, *Recreation, *Wildlife, *Michigan, Hunting, Fishing, Commercial fishing, Market value, Evaluation, Pricing, Coasts, Trapping, Social aspects, Return(Monetary), Benefits.

Gross annual return from Michigan's 105,855 acres of coastal wetlands is estimated on the basis of annual expenditures by recreational participants, standard values of recreation days, and estimated sport and commercial harvests, as part of the Coastal Wetland Value Study. These wetlands generated $489.69/acre for a direct annual gross of $51.8 million in 1977. Average return values per acre by activity were (1) sport-fishing: $286.00; (2) nonconsumptive recreation: $138.24; (3) waterfowl hunting: $31.23; (4) trapping of furbearers: $30.44; and (5) commercial fishing: $3.78. Inclusion of other values such as flood control, groundwater recharge, visual-cultural, sediment trapping, and nutrient uptake which may not be vendable in the marketplace could increase the average return to well over $3,000 acre/year. Regions evaluated included Saginaw Bay with 33,380 acres, Lake Michigan with 29,846 acres, Lake St. Clair and the St. Clair River with 15,630 acres, Lake Erie with 6,715 acres, Lake Huron with 5,685 acres, the Detroit River with 1,420 acres and Lake Superior with 2,200 acres. Phase 2 of the Coastal Wetland Value Study will emphasize the nonvendable aspects of wetlands. (Luedtke-Wisconsin)
W80-01965

THE SIMULATION AND OPTIMIZATION OF A MULTI-BASIN WATER RESOURCE SCHEME IN CYPRUS,
London Univ. (England).
J. K. White, and C. A. Christodoulou.
Proceedings: The Institutions of Civil Engineers, Part 2, p 111-132, March 1979. 5 Fig, 2 Tab, 5 Ref.

Descriptors: *Model studies, *Optimization, *Water supply, *Water resources development, Cyprus, Watershed management, Planning, Multiple purpose projects, Rivers, Reservoirs, Catchments, Methodology, Economics, Decision making, Simulation models.

Planning for water supply development in the southern part of Cyprus is described to illustrate a simulation model of a multi-dimensional coastal system which successfully optimized values of an objective function having 41 decision variables. The system consists of 18 rivers and six major aquifers grouped in nine projects. To meet projected irrigation and domestic demands, constructions sites for six new diversions, and 12 new reservoirs and a conveyor route consisting of 11 open channels have been selected. Capacities of each components were determined by optimizing the economic evaluation of a water balance simulation model. The 41 required decision variables consisted of the capacities and timings of construction of critical system components. System parameters of the Cyprus model include water supply characteristics, economic considerations and a 50 year period of analysis composed of discrete time intervals of one month. Results show that the optimal capacity for reservoir no. 9 which is at the heart of the Cyprus system is 90-100 million cu m and should be constructed in the fourth year. Proposed reservoirs no. 7, 8, and 19 appear to be unnecessary. (Luedtke-Wisconsin)
W80-01968

EQUITY IN COASTAL ACCESS: INCOME AND SPATIAL EFFECTS OF THE BENEFITS OF A NEW BOAT HARBOR IN METROPOLITAN LOS ANGELES,
Center for Natural Areas, Oakview, CA.
P. J. Symonds.
Coastal Zone Management Journal, Vol 5, No 1/2, P 83-106, 1 Fig, 5 Tab, 22 Ref. NOAA 04-5-158-36.

Descriptors: *Recreation demand, *Marnas, *California coastal plan. *Equity, *Benefits, Equitable apportionment, Spatial distribution, Coasts, California, Los Angeles(CA), Construction, Model studies, Income, Environmental effects, Recreation facilities, Wetlands, Boating, Statistical analysis, Planning, Social participation.

Distribution of benefits among income groups around Los Angeles of additional marina construction along the Southern California coastline is analyzed in the context of the recreational boating policies in the California Coastal Plain of 1975. This plan: (1) echoes widespread belief in a continuing unmet demand for boating facilities through the next decade; (2) notes that construction of boating facilities would be environmentally damaging to coastal wetlands; and (3) recommends more frequent use of existing facilities and construction of dry-storage and launching facilities. The plan deals with efficiency questions, but does not consider the issues of equity of access to the resources. Using an empirical estimation of income, spatial, and facility-supply effects on boat ownership, relative distribution of benefits by income and location of new facilities construction is inferred. The need for an analysis of intrametropolitan as opposed to interregional boat ownership is assessed. Household income, residence-to-facility distance, and facility-capacity indicators are suitable predictors of boat ownership and are corporated into a probability model. Demand for new boating facilities is dependent on high family income and distance to the facility, factors which could limit such demand. Th primary benefits of new facility construction would accrue to households in the upper one-tenth of the regions' income bracket, especially those living near the coast. (Luedtke-Wisconsin)
W80-01969

ECONOMICS AND WATER CONSERVATION,
Department of the Interior, Washington, DC. Office of Minerals Policy and Research Analysis.
R. K. Schaefer.
Water and Sewage Works, Vol 126, No 6, p82-86, June 1979. 5 Tab.

Descriptors: *Water conservation, *Economics, *Water demand, Water rates, Toilets, Water supply, Waste water treatment, Water utilization, Water treatment, Cost-benefit analysis, Cost effectiveness, Water users, Shower heads, Washing machines, Facets, Federal Water Pollution Control Act Amendments of 1972, PL 92-500.

Economic analysis for water conservation is explored. Inerest in water conservation has recently increased with passage of the 1972 Federal Water Pollution Control Act Amendments requiring expensive wastewater treatment. Other factors include energy crisis, climate conditions which have reduced water suplies to some heavily populated areas, rapid escalation of costs for developing water supplies including expensive treatment requirements of the Safe Drinking Water Act, and alternative water resources use conflicts. Water conservation plant must include analysis of industrial and domestic consumer use patterns together with price information, available physical and social alternatives, and innovative water suply and wastewater treatment options. Economic analysis of water conservation alternatives also requires that the cost per unit of new capacity be compared with the cost per unit of saving due to conservation. In practice, combinations of education, laws or regulations, devices such as low-flow shower heads, and pricing techniques are used to achieve water conservation. The cost-effectiveness of each must be analyzed to determine a project's value. Tables listing water demand factors and costs and savings of water conserving devices are included. (Luedtke-Wisconsin)
W80-01970

BENEFIT-COST ANALYSIS FOR APPRAISAL OF RECREATION ALTERNATIVES.
North Central Forest Experiment Station, Chicago, IL.
J. F. Dwyer, and M. D. Bowes.
Journal of Forestry, Vol 77, No 3, p 145-147, March 1979, 14 Ref.

Descriptors: *Cost-benefit analysis, *Forests, *Land resources, *Benefits, *Model studies, *Recreation demand, *Willingnes-to-pay, Recreation, Natural resources, Conservation, Land use, Parks, Costs, Economics,Social needs, Travel time, Social behavior, Social values, Social participation, Decision making, Waterfowl.

This paper outlines a methodology for estimating recreation benefits by measuring willingness of users to pay; estimations can be made either by participation behavior of recreation users or by surveying a sample of participants to learn their preferences. Each acre allocated to wilderness costs society stumpage value that could have been harvested from that land. Rather than make arbitrary decisions, managers of public lands can estimate society's willingness to make such trades. Two general methods are: (1) the travel-cost approach for estimating regional demand, and (2) the survey-based method. The former estimates willingness-to-pay from actual participant demand behavior; in the survey method, participants state their degree willingness. The travel-cost method is preferable since it is based on what people do, rather than what they say they will do. Past model construction efforts indicate user behavior and recreation values can be estimated from a small number of variables. One model which predicts the value of waterfowl hunting includes household income (after taxes), number of waterfowl hunting seasons, cost of a season's hunting, waterfowl short and bagged during the season, and number of hunting days during the season. Existing procedures for estimating recreation benefits make it possible to use benefit-cost analysis to evaluate management alternatives. (Danovich-Wisconsin)
W80-02000

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

A MODELING APPROACH TO EVALUATE TIDAL WETLANDS,
Gruman Ecosystems Corp., Bethpage, NY.
For primary bibliographic entry see Field 2L.
W80-01927

AN EFFLUENT CHARGE SCHEDULE: COST, FINANCIAL BURDEN, AND PUNITIVE EFFECTS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
E. D. Brill, Jr., C. Revelle, and J. C. Liebman.
Water Resources Research, Vol 15, No 3, p 993-1000, October 1979. 7 Fig, 4 Tab, 14 Ref. 5T01EC00023.

Descriptors: *Economic efficiency, *Pollution taxes(Charges), *Effluent charge schedule, *Constant unit effluent charge, *Costs, Equity, Delaware, Water quality control, Punitive effects, Financial burden, Economic feasibility, Management, Waste water treatment, Dissolved oxygen, Effluents, Effluent charges.

Constant-unit effluent charge programs and effluent charge schedule programs are compared with regard to cost, charge payments, financial burden, and punitive effects. Data for the Delaware Estuary show that these programs vary considerably and that the charge schedule programs reduce the charge payments and financial burden significantly. While constant-unit charge programs exact much lower cost penalties than corresponding uniform treatment programs, they also require total charge payments of the same magnitude as the total removal cost. These charge totals are an income transfer and their sum constitutes the financial burden. Effluent charge schedule programs reduce this burden by decreasing the charge per unit as the level of waste discharge decreases. This is because the unit charge function lies below the marginal saving function, which also contains a

component for the decreasing value of the unit charge. In the Delaware example, charge schedule programs indicated a 33 percent reduction in the total financial burden and a 70 percent reduction in the charges paid. The sum of the total cost plus charges paid is less than or about the same as the total cost of waste removal alone for the corresponding direct regulation programs, maintaining the economic efficiency advantage while reducing the financial burden. It is noted that a significant part of the charge component of the burden, 30% to 80% of the total charges for constant charge programs is punitive in nature. (Luedtke-Wisconsin)
W80-01962

PHOSPHATE BAN LOWERS REMOVAL COSTS,
Escanaba Wasterwater Treatment Plant, MI.
R. Jacke.
Water and Wastes Engineering, Vol 16, No 8, p 33-35, August 1979. 3 Fig, 2 Tab.

Descriptors: *Phosphates, *Waste water treatment, *Costs, *Phosphorus removal, *Cost analysis, Escanaba(MI), Michigan, Phosphate ban, Ferric chloride, Polymer, Treatment facilities.

Comparison of operational data from the Escanaba Wasterwater Treatment Plant January-October 1977 and the same months in 1978 show that a phosphate ban in Michigan has reduced phosphate concentration in wastewater, thereby significant lower its removal costs. Average total phosphorus influent dropped from 10.6 mg/1 in 1977 to 6.1 in 1978 with implementation of a 5% total phosphorus limit in laundry detergents. As the phosphorus influent decreased, quantities of ferric chloride and polymer needed to maintain the 80% removal standard were reduced. Monthly average ferric chloride required dropped from 13, 516 lb/month to 8, 437 lb/month while polymer useage dropped from 155 lb to 108 lb. This resulted in an average monthly cost/mg reduction from $27.99 to $18.99 and a total average cost reduction from $1,448 to $1,029/mo. Initial data also indicate that sludge production due to phosphorus has been cut by 59,709 lb over the 10mo period saving an additional $1,582 in sludge disposal costs. (Luedtke-Wisconsin)
W80-01971

6D. Water Demand

FORECASTING THE NEED FOR SURFACE WATER USE CONJUNCTIVE WITH GROUNDWATER,
Mississippi State Univ., Mississippi State. Bureau of Business and Economic Research.
R. L. Frnka, and L. R. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116320, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Report, September 1979. 91 p, 11 Fig, 10 Tab, 26 Ref. OWRT B-018-MISS (1), 14-34-0001-8093.

Descriptors: *Capital costs, *Economic feasibility, *Electric power costs, *Operating costs, *Water demand, Filters, Forecasting, Groundwater supply, Planning, Reservoirs, Regression analysis, Surface water supply, Water wells, *Chemical costs, *Labor costs, *Mississippi municipalities, Chlorinators, Integrated water supply.

The objective was to provide a planning model for integrating surface water production into ground water supply systems for the major municipalities in Mississippi. With the use of multiple regression techniques municipal water demand was estimated to be a function of population, industry profile and climatic factors. Forecasts for water requirements were made for future years. Primary data on operation costs and capital costs were obtained from personal interviews from over forty municipalities. Projections of these costs necessary to meet the respective demands for each municipality were made by considering the use of present ground water systems and hypothetical surface water systems. A comparison of costs between the two alternatives was used to determine the feasibility of integrating surface water to ground water production. In general the reduced electric utility costs of surface systems were not adequate to counter their increased chemical and labor costs. However, in a few cases an integrated water system might be feasible if an existing surface water source could be enhanced at a considerable low cost.
W80-01606

EFFECT OF WATER CONSERVATION ON WATER DEMANDS,
Brown and Caldwell, Walnut Creek, CA.
W. O. Maddaus, and D. L. Feuerstein.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR2, p 343-351, September 1979. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Water conservation, *Water plans, *Water demand, *Water consumption, Water utilization, Land use, Regional planning, Water distribution(Applied), Water supply, Methodology, Effects, Estimating, Costs, Programs, Employment, Residential water.

A new method for predicting long-range waer demands was developed to quantify the post-drought effectiveness of water conservation in the San Francisco Bay Area. The method used general relations between water use and population density and employee density that were derived for the Bay Area. Several alternative water conservation programs were tested using the projection model and the resulting water savings ranged from 4% to 16% by the year 2000. The costs of water conservation were compared with those for building new water supply projects. It was concluded that water conservation was more cost-effective than other sources of water supply. (Bell-Graf--Cornell)
W80-01692

EQUITY IN COASTAL ACCESS: INCOME AND SPATIAL EFFECTS OF THE BENEFITS OF A NEW BOAT HARBOR IN METROPOLITAN LOS ANGELES,
Center for Natural Areas, Oakview, CA.
For primary bibliographic entry see Field 6B.
W80-01969

MARINE RECREATION IN THE COASTAL BELT,
Rhode Island Univ., Kensington.
N. Rorholm.
Marine Technology Society Journal, Vol 13, No 2, P 26-29, April/May 1979. 2 Tab, 3 Ref.

Descriptors: *Recreation, *Coasts, *Planning, *Resource allocation, Decision making, Regional economics, Management, Water resources development, Sea water, Beaches, Boating, Swimming, Costs, Taxes, Alternative planning, Recreation demand, Pricing.

The need to more fully analyze the nature of marine recreational activity and to provide a rational basis for resource allocation in the coastal belt (coastal zone plus economic zone) is described. Marine recreation activities are difficult to manage because: (1) they occur both on land where private property rights are definable and partly in water, which is public domain; (2) quality of recreational experience is dependent on various regulative activities; and (3) many different kinds of recreation experiences are desired and these require a wide range of resource combinations. Information is needed on the role of recreation in keeping physically and mentally fit and on the particular aspects of recreation which affect these processes. In addition it is necessary to know the production processs including spillovers and externalities such as employment and income effects since recreation is often used as a tool for regional economic development. A partial list of productive factors for selected types is illustrated. Future growth and conflicts in marine recreation will have to be handled by allocation policies; participation does seem densitive to disposal income changes. Conflicts will arise from recreational versus commercial uses of the seas, competition between indivisuals who live in an areas versus those who make their living from tourism, and from crowding of individual recreation activities such as boating. (Leudtke-Wisconsin)
W80-01972

CURRENT USE OF WATER SURFACE ZONING FOR RECREATION,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Natural Resources.
For primary bibliographic entry see Field 6A.
W80-01973

BENEFIT-COST ANALYSIS FOR APPRAISAL OF RECREATION ALTERNATIVES,
North Central Forest Experiment Station, Chicago, IL.
For primary bibliographic entry see Field 6B.
W80-02000

6E. Water Law and Institutions

WATER SUPPLY AND CONTROL DEVELOPMENT - COLORADO,
Form the State Capitals, p 1-2, September 1, 1979.

Descriptors: *Water rights, *Colorado, *Grand water, *Judicial decisions, Water allocation(Policy), Water law.

In a unprecedented water rights case, 121 claims to Colorado's non-tributary, underground water supplies will be decided. Deliberations will begin after the Colorado Supreme Court clarifies certain questions of law. Opposing the claimants are the federal government, the state of Colorado, many cities in the state, a variety of businesses and industries, and several groups of ranchers, farmers, land developers and individuals who claim that water supplies could be adversely affected by development of the water claims. It may take several years before a final ruling in the case is obtained. (Purdin-MWWA)
W80-01740

NAVIGATION USER CHARGES: IMPACT ON THE TRANSPORTATION OF AGRICULTURAL PRODUCTS,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
J. Binkley, L. Shabman, J. Havlicek, W. Luppold, and R. Stillman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119449, Price codes: A06 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Bulletin 121, October 1979. 97 p, 6 Fig, 18 Tab, 46 Ref. OWRT B-082-VA(4).

Descriptors: *Navigation, *Water policy, *Transportation, *Inland waterways, *Taxes, Fuels, Effects, Agronomic crops, *Waterway user charge, Fuel tax, Economics.

The inland waterways of the United States historically have been maintained and improved by the federal government at no cost to waterway users. However, in 1978 legislation was enacted that imposed a fuel tax on commercial waterway traffic. The debate over this legislation raised concerns that such charges could reduce significantly the freight tonnage carried on the inalnd waterway system and could affect adversely major industries dependent upon water transportation. This research assessed the likely impact of such a charge on the movement of grains and the location of the broiler chicken industry. The results of the analysis suggest that a uniform charge administered as a fuel tax on all waterways would have a small impact on grain movements by barge if full federal operation and maintenance costs are recovered. The recent legislation, which requires a lower fuel tax level, would have virtually no effect on grain movements by barge. A toll tied to recovery of operation and maintenance costs of a particular waterway segment would reduce traffic on the

high-cost waterways, but such traffic represents only a small proportion of the total movements. The results indicate also that any changes in prices for delivered grain that might be brought about by a user charge would not be of sufficient magnitude to affect the broiler industry, whose location and distribution patterns are sensitive to costs of feed grain transportation.
W80-01795

ECOLOGY AND ECONOMICS IN LAGOS STATE,
Ibadan Univ. (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 6A.
W80-01966

CURRENT USE OF WATER SURFACE ZONING FOR RECREATION,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Natural Resources.
For primary bibliographic entry see Field 6A.
W80-01973

6F. Nonstructural Alternatives

FLOOD INSURANCE PROGRAM: REGIONAL AGENCY'S PERSPECTIVE,
Donohue and Associates, Inc., Waukesha, WI.
For primary bibliographic entry see Field 4A.
W80-01686

6G. Ecologic Impact Of Water Development

RESPONSE OF A LAKE WHITEFISH (COREGONUS CLUPEAFORMIS) POPULATION TO EXPLOITATION,
Fisheries and Marine Service, Nanaimo (British Columbia).
M. C. Healey.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 2019-2024. 3 Fig, 4 Tab, 10 Ref.

Descriptors: *Fish populations, *Lake Drygeese(Canada), *Lake Baptiste(Canada), *Whitefish, *Growth rates, *Fish harvest, Lakes, Canada, Growth stages, Population, Fecundity, Size, Mature growth stage, Exploitation, Correcation analysis, Age, Fish reproduction, Life cycles, Fisheries.

In Canadian Prygeese Lake, intensively exploited for whitefish (Coregonus clupeaformis) in 1973-1974, growth rate of some year classes increased significantly and young fish age 0+ and 1+ were largely recruited at exploitation times. Drygeese Lake and the control Lake Baptiste are both located near Yellowknife in the Canadian Northwest Territories. Survey catch per unit effort (CPUE) ranged 9.3-19.6 in Baptiste between 1971 and 1976. In Drygeese, survey CPUE dropped from 17.3 prior to harvest to 5.6 in 1974. During 1973-1974, 6,127 whitefish were removed from Drygeese and by the end of 1974 few whitefish were left. However, the population recovered rapidly and by 1976 CPUE increased to 10.2. As a result of exploitation, all ages show improved growth, while youngest fish show the greatest improvement. Annual growth in weight increased in Baptiste from 28% in 1967 year-class to 54% in 1973 year-class. In Drygeese, 1967 year-class increased 33% and 1973 year-class grew significantly more slower, 36%. Drygeese 1971 and 1972 year-classes grew significantly faster, 57% and 48% respectively. Exploitation in 1973-1974 virtually eliminated older fish; this was followed by a strong recruitment pulse of fish aged 2+ in 1975 and the same year-class, now 3+ in 1976. Abundance of recruits may have inhibited growth as suggested by the slow fish growth rate from the 1973 year-class. (Danovich-Wisconsin)
W80-01789

UTILIZATION OF DISSOLVED ORGANIC CARBON BY HETEROTROPHIC BACTERIA AND PROTOZOA,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
J. M. Graham, R. P. Canale, and S. R. Allen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119498, Price codes: A04 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, East Lansing. Project Completion Report. November, 1979. 48 p, 17 Fig, 5 Tab, 24 Ref. OWRT B-047-MICH (1), 14-34-0001-7121.

Descriptors: *Continuous culture, *Predator-prey, *Heterotrophic microorganisms, Laboratory tests, Bacteria, Trophic level, Carbon cycle, Predation, Protozoa, Mathematical models, *Didinium, *Paramecium, Coulter counter.

This research has investigated in batch and continuous culture laboratory microcosms the relationships between level and turnover rate of dissolved organic carbon substrates and the interactions among microbial populations at three trophic levels in a heterotrophic predator-prey system. Four trophic levels were measured: organic carbon substrates, the bacterium Enterobacter aerogenes (ATCC 13048), grazing ciliate Paramecium primaurelia (stock 540), and predatory ciliate Didinium nastum (ATTCC 303399). A mathematical model based on Monod kinetics was developed for this system. This research indicated that the level and turnover rate of dissolved organic carbon could profoundly affect coexistence and stability of a heterotrophic system. At high nutrient levels interference among predators permit a few prey to survive and repopulate the vessels. Encystment enabled the top predators to survive until prey became abundant and a series of oscillations resulted. When nutrient levels were reduced predators no longer interfered with each other, prey were eliminated, and only bacteria remained. The mathematical model gave a reasonable qualitative description of the observed data from continuous cultures. Actual continuous culture systems were less oscillatory than predicted by the model. No batch and continuous culture studies have previously been reported with as many trophic levels as in this research.
W80-01797

ESTABLISHMENT AND GROWTH OF SELECTED FRESHWATER AND COASTAL MARSH PLANTS IN RELATION TO CHARACTERISTICS OF DREDGED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 2L.
W80-01910

STREAM CHANNEL MODIFICATION IN HAWAII. PART C: TOLERANCE OF NATIVE STREAM SPECIES TO OBSERVED LEVELS OF ENVIORONMENTAL VARIABILITY,
Hawaii Cooperative Fishery Research Unit, Honolulu.
C. B. Hathaway, Jr.
Fish and Wildlife Service Report. FWS/OBS-78/18, October, 1978. 59 p, 11 Fig, 12 Tab, 45 Ref, 1 Append.

Descriptors: *Streams, *Hawaii, *Channeling, *Effects, *Fish, Ecology, Aquatic life, Populations, Habitats, Ecological distribution, Freshwater, Temperature, Hydrogen ion concentration, Riparian land, Concrete construction.

Channel modification in Hawaii has been correlated with increases in physio-chemical variability and reductions in numbers of several endemic gobiid fishes in altered streams. The amphidromous migratory behavior of the native fauna prevents the isolation of any species from the effects of channelization on water quality. Daytime values of conductivity, pH and dissolved oxygen were found to be considerably higher in altered streams than in unaltered streams. All stations located downstream from channel modifications had higher diurnal peak temperatures than upstream and unaltered stream stations. Temperature ext4remes of 36.2C and 17.8C were recorded at the downstream end of a concrete lined channel. Diel changes in temperature of 12C were not uncommon. High illumination due to clearing of the vegetative canopy, and shallow water depths in lined channels appear to be responsible for the excessive heating. Upper lethal temperatures correlated with altitudinal distributions of adult fishes and crustaceans. Lethal limits of those species absent or rare in altered streams fell within the range of temperatures recorded in such degraded habitats. Dominant introduced fishes showed greater resistance to high temperatures than native animals. Maximum growth rates occurred in fluctuating temperatures whose diel maxima were 7-8C below upper lethal limits. (Stihler-Mass)
W80-01911

STREAM CHANNEL MODIFICATION IN HAWAII, PART D: SUMMARY REPORT,
Hawaii Cooperative Fishery Research Unit, Honolulu
J. D. Parrish, J. A. Maciolek, A. S. Timbol, C. B. Hathaway Jr., and S. F. Norton.
Fish and Wildlife Service Report. FWS/OBS-78/19, October, 1978. 18 p, 1 Fig, 5 Tab, 5 Ref.

Descriptors: *Streams, *Hawaii, *Channeling, *Effects, *Fish, Dredging, Concrete construction, Crustaceans, Populations, Vegetation, Ecology, Ecological distribution, Biomass, Hydrogen ion concentration, Turbidity, Temperature, Substrate, Riparian land.

A three-year, statewide study was made of the occurrence and consequences of channelization in Hawaiian streams. The 366 perennial streams of the State were inventoried for the first time, and some basic information was catalogued on their physical characteristics, complete status of channel alteration, and macrofaunal communities. Fifteen percent of the State's streams have channels altered in at least 1 of 6 forms. Forty percent of the State's streams have channels altered in at least 1 of 6 forms. Forty percent of the modified channel length is concrete lined-the form of alteration found to be most ecologically damaging. Field measurements shoewed that channel alterations commonly caused large changes in pH values, conductivity, dissolved oxygen and daily temperatures. The native species tested in the laboratoty had less tolerance of high temperatures than exotics, and some natives had upper lethal temperature limits within the temperature range measured in channelized stream. Twenty-five species of fish and decapod crustaceans were collected statewide, of which only 9 were native. Native species were not abundnant in most heavily channelized sections, whereas native species were almost entirely absent. Recommendations for mitigating the impact of channel modification are included. (Stihler-Mass)
W80-01912

SALT MARSH PLANTS AND FUTURE COASTAL SALT MARSHES IN RELATION TO ANIMALS,
Delaware Univ., Newark. Dept. of Biological Sciences.
F. C. Daiber.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.), Academic Press, Inc., New York, p 475-508, 1974. 1 Fig, 5 Tab, 111 Ref.

Descriptors: *Marsh plants, *Marsh management, *Wildlife habitat, Wetlands, Salt marshes, Marshes, Halophytes, Burning, Ditches, Dikes, Mosquitoes, Impoundments, Wildlife, Distribution patterns.

A literature review is conducted of the types of salt marsh management and their effects on plant distribution and wildlife habitat. (Steiner-Mass)
W80-01923

AN OVERVIEW OF RIVER-BASIN ASSESSMENT TECHNIQUES IN AN ENERGY-IMPACTED REGION--YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Denver, CO.
T. D. Steele.

Water Supply and Management, Vol 3, No 3, p 151-171, 1979. 10 Fig, 2 Tab, 29 Ref.

Descriptors: *River basin development, *Colorado River development, *Remote sensing, *Water resources development, *Environmental effects, *Coal mines, Alternative planning, Energy, Regional development, Regional analysis, Economic impacts, Rocky Mountain Region, Comprehensive planning, Assessments, Evaluation, Data collections, Model studies, Yampa River Basin, Colorado, Wyoming.

Reported here are the results of completed basin assessment studies of the Yampa River Basin in northwestern Colorado and south-central Wyoming that had as their objectives (1) to evaluate the environmental and economic impact of regional energy and water resource development for existing and feasible alternative policies, and (2) to describe the assessment methodologies used so that they may be applied to other energy-rich regions of the western U.S. where water resources are limited. A set of 7 coal-resource development alternatives are specified in order to evaluate the effects of possible water demands and generated residuals on the region's water resources. The resultant analyses consider both the direct effects of coal mining, processing, conversion and transportation and the indirect effects of increased population and related commercial and service needs. Based upon extensive field collection of hydrologic data and the analysis of regional economic projections, a range of impacts of the projected development on the basin's water resources are evaluated using several data-analysis and physical modelling techniques. (Tickes-Arizona)
W80-01952

7. RESOURCES DATA

7A. Network Design

COMPUTER MODELS TO PREDICT GROUND WATER CHANGES,
Ground Water Age, Vol 13, No 11, p 27, 40, July, 1979.

Descriptors: *Computer models, *Aquifier systems, *Forecasting, Regional analysis, Ground water basins, Ground water movement, Water quality.

The U. S. Geological Survey has begun a program to develop computer models of the overall aquifer system of six ground water regions of the United States; the northern Great Plains region; the High Plains region; the Central Valley of California; the sandstone aquifiers of the northern Midwest, the alluvial valleys of the Southwest, and the limestone aquifers of Florida, Georgia and neighboring states. The models will aid in identifying the natural (pre-pumping) conditions and the changes brought about by human activities. They will also help in predicting the areal effects of present and future stresses, such as increase in pumping, artificial recharge, or waste disposal. (Purdin-NWWA)
W80-01682

MONITORING CHANGES IN GROUND WATER QUALITY,
For primary bibliographic entry see Field 5B.
W80-01700

MONITORING LANDFILLS,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5A.
W80-01731

FISH COMMUNITIES OF THE MANITOULIN ISLAND LAKES,
Toronto Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 8I.
W80-01791

INFLUENCE OF STARVATION ON WHITEFISH (COREGONUS LAVARETUS L.) LARVAE,
For primary bibliographic entry see Field 8I.
W80-01794

TARP GROUNDWATER MONITORING, SUMMARY REPORT (OCTOBER, 1976-SEPTEMBER, 1977),
Metropolitan Sanitary District of Greater Chicago, IL. Research and Development Lab.
For primary bibliographic entry see Field 5B.
W80-01896

7B. Data Acquisition

THE PERFORMANCE OF A WAVE GAUGE IN BUBBLY WATER--WHAT DOES IT MEASURE,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2L.
W80-01809

PERFORMANCE OF A F.R.P. PAN EVAPORIMETER,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2D.
W80-01829

LIGHT SCATTERING AND EXTINCTION IN A HIGHLY TURBID COASTAL INLET,
Harbor Branch Foundation, Inc., Fort Pierce, FL. Remote Sensing Services.
M. J. Thompson, L. E. Gilliland, and L. K. Rosenfeld.
Estuaries, Vol 2, No 3, p 164-171, September 1979. 4 Fig, 2 Tab, 17 Ref.

Descriptors: *Inlets(Waterways), *Turbidity, *Suspended solids, *Remote sensing, Coasts, Rivers, Estuaries, Light, Optical properties, Surveys, Organic matter, Chemicals, Particle size, Instrumentation, Light scattering, Light extinction.

Multifactor regression analysis was used to test for relationships between chemical, physical, and optical properties of the water column in the organically rich, highly turbid waters of Florida's Fort Pierce Inlet. Optical measurements were made at three visible light wavelengths (445 nm, 542 nm, and 630 nm). Scattering by suspended particulate material was found to be the primary optical mechanism controlling down-welling irradiance at all three wavelengths. Larger particles showed constant scattering efficiencies of 2 when their diameters exceeded 3 to 5 microns, depending upon the wavelength used for observation. Selective absorption had a definite effect on the transmission of radiant energy in the 445 nm wavelength range. High correlation between extinction at 445 nm and the cross-sectional area of the suspended particulate material indicates that particulate, rather than dissolved materials, are the major water column constituents that selectively absorb short wavelength radiant energy in this inlet. Spectral distribution of the downwelling radiant energy field was found to shift dramatically over a period of several months. These shifts in downwelling spectral irradiance were attributed to seasonal and/or event related shifts in concentrations of selectively absorbing compounds within the water column. (Sims-ISWS)
W80-01843

SURVEY OF THE POLLUTION IN A COASTAL AREA OF THE TYRRHENIAN SEA. AERIAL PHOTOGRAPHY, PHYSICO-CHEMICAL AND MICROBIOLOGICAL INVESTIGATIONS AND MUTAGENIC MONITORING,
Genoa Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5B.
W80-01865

ASSESSMENT OF AN AMPEROMETRIC MEMBRANE PROBE FOR DETERMINING FREE RESIDUAL CHLORINE IN SALINE COOLING WATERS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
N. A. Dimmock, and D. Midgley.
Water Research, Vol 13, No 11, p 1101-1104, 1979. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Cooling waters, *Chlorine, *Measurement, *Instrumentation, Equipment, Laboratory tests, Chlorination, Bromine, Salinity, Chemistry, Hydrogen ion concentration, Temperature, Water temperature, Analytical techniques, Coasts, Estuaries.

Cooling water at coastal and estuarine power stations is chlorinated to inhibit mussel growth in the intakes to the condensers, and a means of automatically monitoring the free residual chlorine concentration is desired so that the dosage can be precisely maintained at 0.2 microgram/milliliter C12. The Delta Scientific model 82124 amperometric membrane probe has been tested in the laboratory for its suitability for this application. The probe had a linear response to hypochlorous acid over the range 0-5 microgram/milliliter, but it was not specific for free residual chlorine, as chloramines also produced a response. The main product of the chlorination of seawater is bromine, to which the probe is about five times more sensitive than to hypochlorous acid. Although the probe can be calibrated with bromine, its repsonse is then much noisier than that obtained with hypochlorous acid. The salinity of the sample influencesthe reading obtained at a given concentration of oxidant: increasing the salinity increases the reading obtained with hypochlorous acid but decreases that obtained with bromine. (Sims-ISWS)
W80-01867

RELATION BETWEEN WEST COASTAL RAINFALL AND NIMBUS 6 SCAMS LIQUID WATER DATA OVER THE NORTHEASTERN PACIFIC OCEAN,
Stanford Research Inst., Menlo Park, CA.
W. Viezee, H. Shigeishsi, and A.T.C. Chang.
Journal of Applied Meteorology, Vol 18, No 9, p 1151-1157, September 1979. 5 Fig, 2 Tab, 8 Ref. NASA NAS5-24450.

Descriptors: *Remote sensing, *Rainfall, *Coasts, *Pacific Ocean, Satellites(Artificial), Data processing, Storms, Extratropical cyclones, Precipitation(Atmospheric), Microwaves, Model studies, Mathematical models, Meteorology, Nimbus 6.

A research study was described in which the application to rainfall predicition of cloud liquid water data obtained from the SCAMS experiment of Nimbus 6 was explored. The study area was the Pacific Northwest coast of the United States, where rainfall is produced by extratropical storms that approach from across the Pacific Ocean. SCAMS data related to cloud liquid water over the ocean, and coastal rainfall data were analyzed for 20 different storm systems in the northeastern Pacific Ocean; these produced significant rainfall from Washington to centeral California during the period October 1975-March 1976. Results showed that the distribution of storm-cloud water analyzed from the SCAMS data over the ocean foreshadows the distribution of coastal rainfall accumulated from the storm at a later time. It was concluded that passive microwave sensor measurements of cloud water over the ocean, when used in conjunction with numerical and other objective guidance, can be used to enhance the accuracy of predictions of coastal rainfall distribution. Limitations in the SCAMS measurements and in the data analysis and interpretation were noted. (Sims-ISWS)
W80-01889

MANY USES AND MANY USERS: SOME DESIRABLE CHARACTERISTICS OF A COMMON LAND AND WATER CLASSIFICATION SYSTEM,
Utah State Univ., Logan. Dept. of Forestry and Outdoor Recration.
L. S. Davis, and J. A. Henderson.
In: Classification, inventory, and analysis of fish and wildlife habitat-the proceedings of a national

symposium, January 24-27, 1977, Phoenix, Arizona, Pub. FWS/OBS/-87/76, p 13-34. (1978), 11 Fig, 2 Tab.

Descriptors: *Evaluation, *Systematics, *Design, Aquatic habitats, Terrestrial habitats.

Many needs for classification and many different classification systems exist. A common framework for classifictionis neceassary. Users and user requirements of classification systems are listed. The functional role of classification is formally established via a problem solving model. Three approaches to classification: identifying and classifying environments by components such as soil, vegetation, etc., integrating via the permultations of two or more components; and regionalizing the classifying and delineatin space based on environmental relationships. Characteristics of a classification framwork are; a family of related classification systems are needed since a single system cannot cover all needs; this family should consist of such stable components as bedrock, soil, etc.; each of these components should be hierarchiecally classified; classifications which are regionalizations or integrations should be designed for a stated purpose; experience, knowledge, and data should be identified, labeled, and stored by the component classification; applied classifications should be validated against the their stated purpose; and the logic and language of all classifiction should be communicable to the nonspecialist. (See also W80-01897) (Otello-Mass)
W80-01898

A DIGITIZED CLASSIFICATION SYSTEM FOR THE NATURAL VEGETATION OF NORTH AMERICA WITH HIERARCHICAL SUMMARY FOR WORLD ECOSYSTEMS,
Arizona Game and Fish Dept., Phoenix.
For primary bibliographic entry see Field 6B.
W80-01905

A DATA COMPILATION PROGRAM FOR WETLAND EVALUATION,
Beak Consultants, Inc., Portland, OR.
For primary bibliographic entry see Field 6B.
W80-01907

MONITORING AREAWIDE RURAL WATER QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W80-01976

THE CULTURE COLLECTIONS OF ALGAE AT THE UNIVERSITY OF TEXAS AT AUSTIN,
Texas Univ. at Austin. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W80-01981

7C. Evaluation, Processing and Publication

COMPUTER MODELS TO PREDICT GROUND WATER CHANGES,
For primary bibliographic entry see Field 7A.
W80-01682

WATER RESOURCES INVESTIGATIONS IN NEW YORK-1978,
Geological Survey, Albany, NY. Water Resources Div.
A. J. Finch.
Geological Survey New York District report, 1979. 57 p, 7 Fig.

Descriptors: *Water resources, *Investigations, *New York, *Projects, *Reviews, Programs, Surface waters, Groundwater, Water quality, Bibliographies, Publications, *U.S. Geological Survey, *Water Resources Division.

This report relates the functions of the Water Resources Division of the U.S. Geological Survey and describes in some detail its work in the State of New York during 1978. The New York District office is located in the U.S. Post Office and Courthouse in Albany. Subdistrict offices are located in Syosset. Ithaca, and Albany, with field offices in Middletown and Potsdam. A bibliography of reports published or released in 1978 by the New York District is included. (Woodard-USGS)
W80-01702

STORAGE COEFFICIENTS FROM GROUND WATER MAPS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Civil Engineering.
B. M. Sahni, and H. S. Seth.
Journal of the Irrigation and Drainage Div., Proceedings of the American Society of Civil Engineers, Vol 105, No IR2, p 205-213, June, 1979. 4 Fig, 6 Ref.

Descriptors: *Storage coefficient, *Maps, *Potentiometric level, Transmissivity, Aquifer testing, Observation wells.

The construction of observation wells for aquifer tests is expensive and time-consuming. Transmissivity, but not the storage coefficient, can be estimated from the pumping well data alone. A method is proposed for the determination of the storage coefficient from the slopes of the ground water piezometric surface and the aquifer transmissibility. Two sets of piezometric contour maps are drawn from data recorded at an interval of a few days at a few selected points. These maps determine whether the slope of the piezometric surface is constant. The method was applied to an actual field problem and the results compared favorably with those obtained from aquifer test data. (Purdin-NWWA)
W80-01736

A CASE STUDY OF DRAINAGE INVESTIGATIONS AT GOVERNMENT AGRICULTURAL FARM, HANSI AND ITS ADJOINING AREAS,
Haryana Agricultural Univ. (India).
For primary bibliographic entry see Field 2F.
W80-01808

PERFORMANCE OF A F.R.P. PAN EVAPORIMETER,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2D.
W80-01829

ANNOTATED BIBLIOGRAPHY: WETLANDS VALUE STUDY.
Eastern Michigan Univ., Ypsilanti. Dept. of Geography and Geology.
E. Jaworski, C. N. Raphael, D. L. Tilton, R. H. Kadlec, and B. R. Schwegler.
Michigan Department of Natural Resources, Division of Land Resource Programs. July, 1977. 369 Ref.

Descriptors: *Abstracts, *Michigan, *Wetlands, Coastal marshes, Bibliographies, Reviews, Economics, Value.

Over three hundred abstracts are given on the ecological functions and economic values of wetlands, with particular emphasis on Michigan's coastal wetlands. (Steiner-Mass)
W80-01931

8. ENGINEERING WORKS

8A. Structures

SLOW SAND FILTERS FOR THE LEYTE METROPOLITAN WATER DISTRICT,
Trans-Asia, Manila (Philippines).
For primary bibliographic entry see Field 4A
W80-01648

PERFORMANCE MATCHING AND OPTIMIZATION OF WIND POWERED WATER PUMPING SYSTEMS,
Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 8C.
W80-01711

PRIMITIVE WELL DRILLING TECHNIQUES - PART I,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol. 33, No. 10, p 44-46, September 1979. 4 Fig.

Descriptors: *Drilling, *History, *Drilling equipment, Technology, Boreholes, Saline water, Water wells.

In developing countries, primitive drilling techniques may be more useful and beneficial than modern methods. Percussion drilling systems were developed in different parts of the world, but the basic tools used were similar and have not changed much in the last 3000 years. Three basic power systems were used: the springboard, springpole, and walking beam. The Chinese springboard system used a crew of laborers who jumped on and off one of a plank. The drilling tools were tied to the opposite end and were raised and lowered at a rate of twenty to forty strokes per minute. The Amerian springpole system consisted of a long, straight pole which supported the tools and generated a lifting/dropping motion. A stirrup device attached to the drilling line allowed two or three men to kick down on the pole to produce the reciprocal percussive motion. With the advent of steam power, the springpole method was replaced by the walking beam which was raised and lower with mechanical (steam) power. The walking beam was the forerunner of the potable drilling rig. (Purdin-NWWA)
W80-01741

LIFTING DEVICE FOR WATER, WASTE WATER, SLUDGE AND THE LIKE,
Maschinenfabrik Hellmut Geiger, Karlsruhe (Germany, F.R.)
B. Botsch, and W. Marzluf.
U.S. Patent No. 4,136,636, 6 p, 8 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 123, August 7, 1979.

Descriptors: *Patents, *Water conveyance, Conveyance structures, Treatment facilities.

The invention relates to a conveying device for the conveyance of water or of aqueous liquids and in particular to a device for the conveyance of waste water, by means of a conveying wheel which includes conveying cells arranged in circular form. The characteristic feature is that in the upake region, the conveying wheel, which is provided with one-sidedly open cells lying in a plane perpendicular to the axis of rotation, dips into the level of liquid; that at least the region of the upward conveyance is covered over by a stationary wall portion, which closes off the one-sidedly open cells of the conveying wheel along the conveying route; and that in the discharge region a receiving vessel is located, the leading edge of which extends in axial direction up to the edge of the conveying wheel. (Sinha-OEIS)
W80-01939

8B. Hydraulics

STORAGE COEFFICIENTS FROM GROUND WATER MAPS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Civil Engineering
For primary bibliographic entry see Field 7C.
W80-01736

STEADY SUPERCRITICAL FLOW DOWN AN INCLINED PLANE,

Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
F. Engelund.
In: Progress Report No 48, p 25-30, April 1979. 3 Fig, 1 Tab, 1 Ref.

Descriptors: *Supercritical flow, *Open channel flow, *Flow, Steady flow, Model studies, Mathematical studies, Orifices, Theoretical analysis, Analytical techniques, Analysis, Laboratory tests, Foreign research, Inclined plane.

The problem discussed was the spreading of a steady flow discharged from a rectangular orifice at the top of an inclined plane. The character of this three-dimensional flow is so complicated that a theoretical solution is not readily available, but certan important information may be obtained by a dimensional analysis. For the sake of simplicity, only supercritical flow was considered. The analysis was based on experiments. To obtain a set of approximate equations describing the flow, the two components of the momentum equation considered were in the direction of the jet axis and at 90 degrees to the jet axis. In the experiments the dimensions of the rectangular outlet were 200 x 25 mm, the slope was either 3.3 deg or 7.65 deg, and the Manning number was 70 m to the 1/3 power/s. The Froude number at the outlet varied from 2.6 to 7. The depth, y, was measured by point gage and varied between 25 and 5 mm. Even when the basic equations are considered non-parametric, complete similarity cannot be expected close to the outlet because its geometrical proportional does not automatically correspond to the scaling defined by the analysis. Correction was made by introducing a distance delta x between the theoretical origin of x and the outlet section, determined to give the best fit. The use of relevant scaling reduced the scatter to an acceptable level, particularly where the width is concerned. For the depth, the scatter is somewhat larger, which is not surprising as the experimental accuracy in the determination of y is much smaller. (Humphreys-ISWS)
W80-01812

AN EXPERIMENTAL STUDY OF HYDRAULIC AND GEOMORPHIC CHANGES IN AN ALLUVIAL CHANNEL INDUCED BY FAILURE OF A DAM,
Colorado State Univ., Fort Collins. Engineering Research Center.
For primary bibliographic entry see Field 2E.
W80-01816

WAVE MOTION IN ROCKFILL EMBANKMENTS,
New Orleans Univ., LA. School of Engineering.
A. A. Hannoura, and J. A. McCorquodale.
Advances in Water Resources, Vol 2, No 3, p 149-152, September 1979. 9 Fig, 5 Ref.

Descriptors: *Embankments, *Waves(Water), *Model studies, *On-site investigations, Mathematical models, Finite element analysis, Analytical techniques, Rocks, Rockfill dams, Porous media, Water levels, Water level fluctuations, Hydraulics, Rockfill embankments, Wave motion.

A combined, finite element method of characteristics was used to simulate wave motion in sloping multilayered embankments. Experimental investigation was undertaken to obtain representative interface boundary conditions and to verify the numerical model. The numerical and experimental results of the internal water surface were in good agreement. Further study is needed to refine the interface boundary conditions. (Sims-ISWS)
W80-01848

DIRECT ANALYTICAL SOLUTIONS FOR APPROXIMATE SURGE ANALYSIS,
Memorial Univ. of Newfoundland, St. John's. Faculty of Engineering and Applied Science.
E. Moore, and J. J. Sharp.
Advances in Water Resources, Vol 2, No 3, p 145-147, September 1979. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Surges, *Surge tanks, *Reservoirs, *Mathematical models, Model studies, Tunnels, Tunnel hydraulics, Water tanks, Equations, Mathematics, Hydraulics, Calculators, Calculators equations.

The derivation, and validity, of the basic differential equations for variation of water level in simple surge tanks has been adequately described and documented. Surge heights were calculated from a dynamic equation and from a continuity equation. If friction is assumed to be negligible, a direct solution is available. But in all other cases, it is necessary to solve the equations by numerical techniques. A finite difference approach is commonly employed, but accuracy is achieved only if the time increment is small in which case computation costs may be excessive. The logarithmic method overcomes this problem, but it provides only maximum and minimum values for surge heights and suffers from the disadvantage that it requires an iterative solution. Despite the advances which have been made, however, the only straightforward, non-iterative methods which have received general acceptance are based on the finite difference approach using a digital computer. Still there are disadvantages. The cost is high. Not all engineers have quick and easy access to a computer, and, if a problem is in the design stage, the analysis of trial configurations is best handled by a system giving immediate answers. Other alternatives are available, however. Hand calculators have become cheap. Problems previously handled by computers can be tackled with ease, although step-by-step numerical integration still causes difficulty. Calculators are most useful when a set of fundamental equations can be re-arranged to give an exact direct solution or, if this is not possible, when an approximate solution can be obtained. In this paper it was shown that the transformation of equations into approximate equations capable of direct solution leads to answers comparable to those achieved using conventional methods. The equations developed are easily solved on hand calculators and are, therefore, particularly useful in the design stage where the main characteristics of a number of proposals can be quickly established. (Sims-ISWS)
W80-01849

HEAT RECIRCULATION INDUCED BY THERMAL DIFFUSERS,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-01879

SHEAR-STRESS DISTRIBUTION IN STABLE CHANNEL BENDS,
Calgary Univ. (Alberta). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01880

8C. Hydraulic Machinery

PERFORMANCE MATCHING AND OPTIMIZATION OF WIND POWERED WATER PUMPING SYSTEMS,
Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
G. N. Brogg, and W. L. Schmidt.
Energy Conversion, Vol 19, No 1, p 33-39, January, 1979. 6 Fig, 1 Tab, 7 Ref.

Descriptors: *Pumps, *Windmills, *Wind velocity, *Power system operation, Pump turbines, Performance, Design criteria, Optimization, Efficiency.

A systematic approach for matching windmills and waterpumps to give optimum performance is presented using dimensional analysis techniques. Input data for the analysis include: wind speed frequency and duration; pumping parameters; and windmill and pump characteristics. Most pumps and wind turbines have optimum characteristics within a given operating range. When this information is available, the best pump and windmill for a specific application can be selected, and the design and off-design performance of the total system can be predicted. Generally, the best system will provide the required amount of water with a minimum cost and maximum availability. The concept of power specific tip speed is introduced. This is used to facilitate the matching of windmills and pumps at the design wind velocity in a general manner for a variety of situations. (Purdin-NWWA)
W80-01711

GROUND WATER HEAT PUMPS - THE NEW ALTERNATIVE,
Western Ground-Water Consultants, Winnipeg (Manitoba).
J. Phimister.
Canadian Water Well, Vol 5, No 3, p 22-23, August, 1979. 1 Fig.

Descriptors: *Heat pumps, *Ground water, *Canada, Heating, Energy, Efficiency, Non-Consumptive use.

Ground water is a rapidly renewable, easily accessible, widespread, non-polluting energy source when used in conjunction with a heat pump. A ground water heat pump has a coefficient of performance (COP) of about 3. COP is the ratio of energy output to energy input. The quantity of heat required for a specific application determines the required pumping rate. Since the ground water is returned to the aquifer, there is no consumptive use. The abundance of ground water and the high energy requirement for heating in Canada (65 percent of all energy consumed) makes the ground water heat pump system a viable space heating alternative that should be fully developed as soon as possible. (Purdin-NWWA)
W80-01718

CAUSES AND EFFECTS OF 3-PHASE POWER SYSTEM UNBALANCE,
Water Systems Council, Chicago, IL.
Ground Water Age, Vol 13, No 11, p 22-24, 40, July, 1979.

Descriptors: *Pumps, *Electrical motors, *Electrical design, Electric currents, Power transformers, Rotors, Electrical equipment, Voltage regulations.

Cuases of unbalanced voltages on submersible pump motors include: overloading the transformers with single phase loads; unsymmetrical transformer banks; unsymmetrial or overloaded distribution lines; unsymmetrical feeders to the motor. Some problems caused by unbalanced voltages are: excessive current in one or more stator windings; overheating of the rotor; noise and torsional vibration in the motor and load. Graphs are presented showing the current unbalance and the increase in winding loss in the hottest phase of the machine for a given amount of voltage unbalance. There seems to be no economical solution to the unbalanced problem and detailed analytical study of each individual problem does not seem feasible. However, most problems that occur can be either solved or avoided by conservative sizing and good practice with respect to both the motor and the distribution system components. Advance information about the likelihood of voltage unbalance in a particular distribution system can serve as a basis for sizing the motors and the protective circuitry. Power distribution systems using open wye-open delta transformer banks to supply induction motors should receive special attention to insure that both line and transformer impedences are kept to a minimum and transformer size matches the load. (Purdin-NWWA)
W80-01730

ELECTRIC GENERATING WATER POWER DEVICE.
U.S. Patent No 4,163,905, 11 p, 10 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 203-204, August 7, 1979.

Descriptors: *Patents, *Electric power production, Electrical equipment, Subsurface waters, Generators, Currents(Water).

The object of the invention is to provide a submerged water power machine employing rows of blades arranged in an endless path configuration

for converting water current energy into movements of the blades, the blades being supported at their tops and bottoms for holding them in stable working positions and the blades providing a very large working area exposed to the moving water currents so that the machine has relatively high capacity and is of reasonably confined bulk, as well as being relatively inexpensive to maintain in operating condition and requiring a minimum amount of human supervision. (Sinha-OEIS)
W80-01932

UNDERSTREAM TURBINE PLANT,
L. Skendrovic.
U.S. Patent No 4,163,904, 9 p, 6 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 985, No 1, p 203, August 7, 1979.

Descriptors: *Patents, *Electric power production, *Electric equipment, *Currents(Water), Ocean currents, Turbines, Underflow, Subsurface waters, Gulf Stream.

An understream turbine plant is provided for generating electrical power by means of the flow of an understream effluent, such as the Gulf Stream off the Atlantic seaboard coast. Each turbine plant has a large central opening with a large turbine impeller within it. An electrical generator is mounted with the water-tight housing of the plant adjacent to the central opening. The opening of the plant has a large diameter forward entrance and a large diameter rearward exit with a central portion of smaller diameter. The impeller of the turbine plant is mounted in the smallest diameter part of the opening. The contour of the opening provides for a Venturi effect increasing the efficiency of plant operation. A number of plants may be provided to span at least a portion of the understream flow, as well as being placed in a stacked arrangement to span at least a portion of the height of the understeam flow. Special bearing seals for the rotating impeller prevent the ocean water from entering the interior of the turbine housing. (Sinha-OEIS)
W80-01933

8I. Fisheries Engineering

INITIAL IMPACTS OF EXPERIMENTAL FISH INTRODUCTIONS ON THE MACROZOOPLANKTON OF SMALL OLIGOTROPHIC LAKES,
British Columbia Univ., Vancouver. Faculty of Forestry.
For primary bibliographic entry see Field 5G.
W80-01767

APPLICATION OF STREAM ECOLOGY TO RAISING SALMON SMOLTS IN HIGH DENSITY,
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 5G.
W80-01768

DIET OF BROOK TROUT (SALVELINUS FINTINALIS MITCHELL) AND BROWN TROUT (SALMO TRUTTA L.) IN AN ALPINE STREAM,
Maryland Univ., College Park, Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W80-01770

RISE AND COLLAPSE OF AN INTRODUCED FISH, MORNONE MISSISSIPPIENSIS IN CLEAR LAKE, IOWA,
Iowa State Univ., Ames. Dept of Animal Ecology.
For primary bibliographic entry see Field 5C.
W80-01771

FEEDING BEHAVIOR AND TERRESTRIAL LOCOMOTION IN THE CYPRINODONTID FISH, RIVULUS HARTII (BOULENGER),
University of Western Ontario, London. Dept. of Zoology.
B. H. Seghers.
In: Proceedings: Congress in Denmark 1977 Part 3, 1977; Internationale Vereinigung fur Theoretische und Angerwandte Limnologie, Vol 20, 1978, p 2055-2059. 5 Fig, 1 Tab, 11 Ref.

Descriptors: *Petite Curucaye River(Trinidad), *Standing waters, *Killifishes, *Fish behavior, *Fish food organisms, *Predation, Trinidad, West Indies, Ponds, Minnows, Fish, Fish diets, Aquatic environment, Fish establishment, Fish migration, Fish physiology, Fish populations, Fish types, Aquatic insects, Length, Fisheries.

A tropical fish, Rivulus hartii forages effectively on insect fauna on overhanging vegetation by aerial jumping; this terrestrial feeding behavior, coupled with excellent land mobility, explains its unusually high biomass in small, often temporary, remote aquatic habitats in northern Trinidad, West Indies. One typical stream containing several small pools with a maximum depth 8-28 cm, the Petite Curucaye River, a tributary of Santa Cruz River, was observed 1967-1977. The 35 m experimental section contains 245 Rivulus and 464 guppies, and Poecilia reticulata, the only other fish present. Biomass is 124.3 kg/ha for Rivulus and 37.1 kg/ha for Poecilia. The largest observed Rivulus was 90 mm long and 11.4 g; most were 10-30 mm long. Main food organisms include Formicidae, Coleoptera adults, and juvenile Poecilia. Rivulus also captures ants and other insects on overhanging vegetation up to 14 cm above the water surface. Maximum horizontal jump is 56 cm and maximum distance covered in five minutes is 363 cm. Most fish explore the area systematically, suggesting that jumps are not random movements. Rivulus appearance in remote temporary forest pools is explained by adult fish moving on damp land. Rivulus occur at very low densities in large rivers, since numerous piscivores are present. Jumping behavior in rivers probably serves as an antipredator function and its role in feeding and overland movement is of secondary importance. (Danovich-Wisconsin)
W80-01772

EFFECT OF FISH (SALVELINUS ALPINUS, ARCTIC CHAR) PREDATION ON THE ZOOPLANKTON IN TEN NORWEGIAN LAKES,
Trondheim Univ. (Norway). Museum.
For primary bibliographic entry see Field 5C.
W80-01773

REMARKABLE YIELD OF BROWN TROUT (SALMO TRUTTA L.) IN LAKES NEAR THE HARDANGER GLACIER, NORWAY,
Trondheim Univ. (Norway). Museum.
For primary bibliographic entry see Field 5C.
W80-01774

VERTICAL DISTRIBUTION OF FISHES IN ONE LAKE DEEP (LAKE KUUSVESI, CENTRAL FINLAND),
Jyvaskyla Univ. (Finland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W80-01777

POPULATION STUDIES OF VENDACE (COREGONUS ALBULA (L.) AND PERCH (PERCA FLUVIATILIS L.) IN A MESOHUMIC OLIGOTROPHIC LAKE,
Joensuu Univ. (Finland). Karelian Inst.
For primary bibliographic entry see Field 5C.
W80-01779

RESPONSE OF A LAKE WHITEFISH (COREGONUS CLUPEAFORMIS) POPULATION TO EXPLOITATION,
Fisheries and Marine Service, Nanaimo (British Columbia).
For primary bibliographic entry see Field 6G.
W80-01789

CHANGES IN THE CHEMICAL COMPOSITION, CALORIFIC AND WATER CONTENT OF YELLOW PERCH FRY, PERCA FLUVIATILIS FLAVESCENS,
Manitoba Univ., Winnipeg. Dept. of Zoology.
M. A. Henderson, and F. J. Ward.
In: Proceedings: Congress in Denmark 1977, Part 3, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978. p 2025-2030, 3 Fig, 16 Ref.

Descriptors: *Yellow perch, *West Blue Lake(Manitoba), *Growth rates, *Period of groth, *Fry, *Fisheries, Perches, Fish, Freshwater fish, Canada, Animal physiology, Biochemistry, Growth stages, Juvenile fish, Fish eggs, Life cycles, Carbon, Nitrogen, Length, Weight, Hatching.

Changes in body content carbon (C), nitrogen (N), and calorific content of yellow perch (Perca fluviatilis flavescens) fry tissues in West Blue Lake, Southwestern Manitoba during summers 1974-1975, can be related to immediate energy requirements of newly hatched fish. Later changes in body C, N, and calorific values are associated with continued development, specifically skeleton mineralization and scale formation. Initial decrease in C content from 515 micro g C/mg Dwt on DAH3 (days after hatching) to 430 micro g C/mg Dwt on Dah21 and increase in N content from 78 micro g N/mg Dwt on Dah3 to 106 micro g N/mg Dwt on Dah21 is related to initial yolk utilization. C values represent fat and carbohydrate in yolk; N values represent yolk protein. Body C content after DAH50 declines to 410 micro g C/mg Dwt as the fish returns from pelagic to littoral zones. A similar decline occurs after DAH50 in body N content, from 105 micro g N/mg Dwt to 83 micro g N/mg Dwt by DAH74. This accounts for the stable C:N ratio which is initially 6.6 due to high C and low N levels, but by DAH21 the ratio is 4.1 and ranges from 3.9 to 4.3 until sample discontinuation on DAH74. Initial increase in water content from 5.1 to 8.8 micro g H20/micro g Dwt by DAH14, and subsequent decline to 4 mg H20/mg Dwt, although associated with growth and development, are not direct evidence of changing metabolism. (Danovich-Wisconsin)
W80-01790

FISH COMMUNITIES OF THE MANITOULIN ISLAND LAKES,
Toronto Univ. (Ontario). Dept. of Zoology.
H. H. Harvey.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, 1978, p 2031-2038. 5 Fig, 2 Tab, 9 Ref.

Descriptors: *Manitoulin Island, *Lakes, *Freshwater fish, *Animal groupings, *Ecological distribution, *Fisheries, *Basic data collections, Lake Huron, Distribution, Distribution patterns, Perches, Pikes, Shiners, Sunfishes, Fish, Coldwater fish, Fish populations, Fish types, Regression analysis, Systematics, Biological communities, Speciation.

Five major fish communities were identified on Manitoulin Island, which has 70 lakes larger than 0.5 km in length and is situated in northern Lake Huron: Manitoulin fish communities are related to lake physical features, especially area and depth. Clustering the 27 fish species by lakes yields three major groupings: cold-water species, frequently occurring warm-water species, and occasional and rare warm-water species. Clustering lakes by fishes yields eight major lake groups. For example, cold-water fishes induce a group of the largest and deepest lakes. Combining these two dendrograms yields a matrix and five fish associations are apparent: (1) Six fish species: northern pike, bluntnosw minnow, yellow perch, Iowa darter, rock bass, small-mouth bass occur most commonly. This community is the major force forming some lake clusters. (2) Thirteen species: rainbow trout, brook trout, brown trout, lake trout, trout perch, burbot, sand shiner, splake, longnose sucker, rainbow smelt, spottail shiner, lake whitefish, lake herring, and wall-eye occur only in deepest lakes and are the cold-water fish community. (3) Seven species white sucker, johnny, darter, blacknose shiner, common shiner, pumpkinseed, mimic shiner, mottled sculpin, are weakly associated with a number of lakes. (4) Golden shiner and blackchin shiner are present in another lake grouping. (5) Five species

central mudminnow, northern redbelly dace, brook stickleback, finescale dace, and fathead minnow are very common in small to medium sized shallow lake. (Danovich-Wisconsin)
W80-01791

A NOTE ON AGING IN FISH WITH SPECIAL REFERENCE TO THE PERCH, PERCA FLUVIATILIS L.,
Freshwater Biological Association, Ambleside (England).
J. F. Craig.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 2064. 3 Fig, 22 Ref.

Descriptors: *Windermere, Great Britain, *Fish reproduction, *Animal growth, *Perches, *Aging(Biological), Fish physiology, Growth rates, Growth stages, Nutrient temperature, Water temperature, Energy, Age, Life history studies, Metabolism, Sexual maturity, Gonads, Size, Longevity, Mature growth stage, Fisheries.

This paper compared growth and aging in 1959 and 1968 year-classes of Windermere perch and concludes that aging is best described by nutrition and growth rather than chronological age. Slow fish growth caused by poor food supply, cold temperatures, overcrowding or a combination of these, implies longer life expectancy than fast fish growth although females grwo faster and live longer than males. April energy contents for total weight and somatic weight at each age for 1959 and 1968 year-class female perches show that energy demand for reproduction increase with age. Gonad-to-somatic ratio curves are very similar for each year-class; although fast growing fish produce large gonads in proportion to soma, energy quantities are no greater than in slow growing sih. It is assumed that energy value per gram of ovary remains constant with age. While early death in fast growing population may not result directly from over-reproduction, this may be the case in slow growing populations. Apparently, fish longevity correlates directly to growth rates. (Danovich-Wisconsin)
W80-01792

GENETIC DIFFERENTIATION BETWEEN VENDACE (CORRGONUS ALBULA (L.)) POPULATIONS IN EASTERN FINLAND,
Joensuu Univ., (Finland). Karelian Inst.
J. Vuorinen, and P. Lankinen.
In: Proceedings: Congress in Denmark 1977, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 2111-2116. 2 Fig, 4 Tab, 9 Ref.

Descriptors: *Vendace, *Finland, *Fish populations, *Fish genetics, Salmonids, Genetics, Spawning, Fish reproduction, Lakes, Fish behavior, Electrophoresis, Fish migration, Fish physiology, Biochemistry, Enzymes, Correlation analysis, Mode of action, Variability, Heterogeneity, Fisheries, Lake Suomunjarvi(Finland), Lake Kahjoonjarvi(Finland).

Genetic variation studies during 1975-1976 between vendace populations living in a limited area, eastern Finalnd, but having been isolated 10,000 years, show that allele frequency differences between lakes is due to selection pressure, assuming that migration occurs. Seven lakes were studied; spawning time varies from October for Lake Koitere, end of December for Lake Suomunjarvi, and October and April (sympatric populations) in Lake Kajoonjarvi. Standard horizontal starch gel electrophoresis techniques were used for assays of liver, muscle, and heart enzymes. About half the vendace loci studied were polymorphic, and the same allele is the common one in all populations. However, the observed polymorphism is unequally distributed. Mean genetic distance between each lake pair is 0.023 and mean heterozygosity for the five polymorphic loci is 0.21. From total variation, 10% is due to lake variability. Populations differences are explained by either random populations drift or selection differences on different alleles in different lakes. However, if more than one individual vendace migrates from lake to lake, population differences are explained by selection pressure rather than random drift. Migration between adjacent lakes reduces divergence between a pair of lakes. Lake Kajoonjarvi has two genetically isolated populations since non-overlapping spawning times are probably heritable; some evidence occurs for differentiation at alpha-Gpdh-1 locus. Differentiation amounts at a locus do not correlate with that locus heterozygosity value. (Danvoich-Wisconsin)
W80-01793

INFLUENCE OF STARVATION ON WHITEFISH (COREGONUS LAVARETUS L.) LARVAE,
B. Jezierska, M. Korwin-Kossakowski, and G. Jowko.
In: Proceedings: Congress in Denmark, Part 3; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, 1978, p 2134-2136. 2 Fig, 4 Ref.

Descriptors: *Salmonids, *Mortality, *Food abundance, *Feeding rates, *Larval growth stage, *Laboratory techniques, Growth stages, Growth rates, Fish establishment, Longevity, Metabolism, Period of growth, Fish hatcheries, Fish management, Fry, Fish diets, Respiration, Oxygen requirements, Oxygen demand, Fisheries.

Laboratory starvation experiments in 1976 and 1977 show that whitefish larvae must be transferred from hatcheries to water bodies containing natural food no later than 15 days after hatching. If food concentration in the water body is low, whitefish larvae transfer should be made even earlier. Experiment temperatures are kept at constant 10C and freshwater zooplankton and Artemia salina nauplii are food sources. Highest survival rates occur when fish larvae are supplied with food since the first day of life, however, after one month, survival never exceeds 50%. Most active food intake occurs when first food is given between the 8th and 10th day of life. When first food contact takes place more than 10 days after hatching, some larvae have difficulty catching flood organisms; on the 18th day, few larvae can catch prey. Larvae fed on the 10th and 15th day after hatching survive at a lower rate, 25%. First feeding on the 16th or 20th day, results in 100% mortality; the longer the delay in first feeding, the sooner death occurs. Starving fish larvae oxygen consumption is similar up to the 16th day, then starving larvae decrease their oxygen consumption, indicating changes in metabolic rate. The 25th day after hatching, when mortality of starved larvae is 50%, their respiration rate amounts to one-third the respiration rate of the same age normally fed larvae. (Danovich-Wisconsin)
W80-01794

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

THE CULTURE COLLECTIONS OF ALGAE AT THE UNIVERSITY OF TEXAS AT AUSTIN,
Texas Univ. at Austin. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W80-01981

10. SCIENTIFIC AND TECHNICAL INFORMATION

10D. Specialized Information Center Services

FLOODPLAIN SERVICES AVAILABLE FROM THE ILLINOIS STATE WATER SURVEY,
Illinois State Water Survey, Urbana.
J. P. Lardner, J. L. Alexander, and M. L. Terstriep.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-121007, Price codes: A02 in paper copy, A01 in microfiche. ISWS Circular 137, 1979. 18 p, 7 Fig, 9 Ref, 2 Append. Ill DOWR 47-26-84-348.

Descriptors: *Illinois, *Flood plains, *Data collections, *Documentation, Flood protection, Hydrologic data, Flood stages, Information retrieval, Information exchange, Flood discharge.

Although the administration of the state floodplain regulations and most local assistance relating to floodplains have been provided by the Illinois Division of Water Resources, certain other services are provided directly by the Illinois State Water Survey (ISWS). These services include: (1) a repository of all available floodplain information, (2) coordination of 100-year discharges through a review and certification procedure, and (3) participation in a state review of floodplain studies and the determination of 'best available elevation data' for local floodplain regulation. It is the purpose of this publication to describe these ISWS services and the means by which they are made available to the public. The Floodplain Information Respository is a surface water report library kept by the ISWS. These reports, currently (1979) numbering over 300, have been submitted by various private, state, and federal agencies. Bibliographic information and applicable keywords have been extracted from each report and entered into the system. The system includes (1) copies of actual surface water reports (if available), (2) a data retrieval computer program, and (3) Data Entry Forms (DEF). The ISWS is responsible for reviewing and coordinating 100-year discharges. Participation in this program as well as the methods used in the program and the eventual certification of 100-year discharges were described. The ISWS also provides a comprehensive 'Local Assistance' program and participates in the 'State Review Procedure' for flood insurance and other regulatory floodplain studies. Procedures for a community needing this assistance were described. (Humphreys-ISWS)
W80-01800

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 6
MARCH 15, 1980

W80-02001 -- W80-02400
CODEN: SWRABW

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 6
MARCH 15, 1980

W80-02001 -- W80-02400

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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02 WATER CYCLE

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

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06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

GEOTHERMAL SPACE HEATING/COOLING--A DIRECT USE OF NATURALLY OCCURRING HOT WATER IN SOUTHERN ARIZONA,
Arizona State Bureau of Geology and Mineral Technology, Tucson.
J. C. Witcher.
Fieldnotes, Vol 9, No 4, p 1-2, December 1979, 1 Fig, 4 Ref.

Descriptors: *Geothermal studies, *Absorption, *Refrigeration, Thermal water, Arizona, Cooling water, Air conditioning, Heating.

The maximum efficient use of the significant geothermal reserves believed to exist in Southern Arizona can be achieved, under proper circumstances, by the utilization of hot water to cool areas of human occupancy. This apparent paradox of using heat to make cold is possible by the not so new technology of absorption refrigeration. Useful also to freeze and preserve food, a geothermal absorption system simply substitutes hot water for the gas or electrically-produced heat used in conventional absorption units. The operation of an ammonia and water absorption refrigeration unit is described here while explaining that water and lithium bromide may also be used in a low pressured process. The use of geothermal space cooling is still under investigation by the Arizona Bureau of Geology and Mineral Technology and will depend upon the location, temperature, production rates, and chemical quality of hot water in Arizona's potential geothermal reservoirs. (Tickes-Arizona)
W80-02204

1B. Aqueous Solutions and Suspensions

INVESTIGATION OF INTERMOLECULAR ASSOCIATION IN CONCENTRATED SOLUTIONS OF CELLULOSE ACETATE,
Carnegie-Mellon Univ., Pittsburg, PA. Dept. of Chemistry.
G. C. Berry, T. S. Sham, and M. A. Leech.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124670, Price codes: A04 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology (1979) 63 p, 16 Fig, 5 Tab, Append. OWRT S-0012 (No 7528) (1), 14-34-0001-7528.

Descriptors: *Reverse osmosis, *Semipermeable membranes, *Aqueous solutions, Cellulose, Solvents, Chemical reactions, *Cellulose triacetate, Intermolecular association, Rheological properties.

The role of intermolecular association in concentrated solutions of cellulose triacetate (CTA) is investigated with respect to its importance in controlling the properties of CTA films formed from concentrated solutions for use, for example, as membranes in desalination by the reverse osmosis technique. The studies reveal the presence of extensive intermolecular association of CTA, even in very dilute solutions. The data also reveal that CTA has a larger unperturbed dimension than secondary cellulose diacetate. Rheological data obtained on some moderately concentrated solutions also exhibit the effects of interchain association. It appears that association leads to the formation of loci of imperfectly ordered domains that at as crosslinks, forming a type of randomly branched structure. This extent of this structure may control the properties of films formed from such solutions.
W80-02297

INVESTIGATIONS ON POPULATION DYNAMICS OF WATER BEETLES OF TWO SWAMPS IN THE NORTHERN AREA OF THE BLACK FOREST. POPULATIONSDYNAMISCHE UNTERSUCHUNGEN AN WASSERKAFERN ZWEIER HOCHMOORE DES NORDSCHWARTZWALDES,
Stuttgart Univ. (Germany, F. R.). Zoologisches Inst.
V. K. Dettner.
Archiv fur Hydrobiologie, Vol 77, No 3, p 375-402, Mai, 1976. 11 Fig, 5 Tab, 45 Ref. (Summary in English).

Descriptors: *Aquatic insects, *Water beetles, *Swamps, *Ecological distributions, Wetlands, Hydrogen ion concentration, Ecology, Insects, Aquatic animals, Invertebrates, Germany.

The relative abundances and frequencies of 39 species of water beetles were examined in small water areas in two swamps in the northern areas of the Blackforest. In contrast to the Palpicornia, three representatives of the Hydradephaga show correlations between their dominances and abiotic factors: Agabus sturmi prefers water with a high pH; A. melanarius prefers water with a high level of humic-acids; Hydroporus tristis prefers water with a low hardness. Marking experiments with three beetle species capable of flight indicate that A. melanarius and A. sturmi are relatively stationary; Hydrobius fuscipes is not. The results of qualitative samples show that small waters within these swamps are marked by a constant inventory of species. (Stihler-Mass)
W80-02308

2. WATER CYCLE

2A. General

RECYCLING OF WATER IN THE AMAZON BASIN: AN ISOTOPIC STUDY,
Comissao Nacional de Energia Nuclear, Sao Paulo (Brazil).
E. Salati, A. Dall'Olio, E. Matsui, and J. R. Gat.
Water Resources Research, Vol 15, No 5, p 1250-1258, October 1979. 5 Fig, 19 Ref.

Descriptors: *Hydrologic cycle, *Precipitation(Atmospheric), *Evaporation, *Isotopic studies, *South America, Rainfall, Rivers, Sampling, Oxygen isotopes, Data processing, Regression analysis, Clouds, Weather, Meteorology, Tropical regions, Watersheds(Basins), *Brazil, *Amazon Basin.

The oxygen-18 content of precipitation in the Amazon basin is characterized by a very small inland gradient, 0.00075 parts per thousand/km. This is a consequence of the large contribution of reevaporated moisture to the basin's water balance. A distinct seasonal and regional pattern of stable isotope composition has been recognized and shows the basin to be inhomogeneous from the hydrometeorological point of view. The occasional appearance of very low delta values is believed to be related to the position of the ITCZ rather than to interbasin processes. (Sims-ISWS)
W80-02181

EVIDENCE OF ACIDIFICATION OF HEADWATER STREAMS IN THE NEW JERSEY PINELANDS,
Pennsylvania Univ., Philadelphia.
For primary bibliographic entry see Field 5B.
W80-02190

A CLIMATIC DELINEATION OF THE 'REAL' CHIHUAHUAN DESERT,
Texas Univ. at El Paso. Dept. of Geological Sciences.
R. H. Schmidt, Jr.
Journal of Arid Environments, Vol 2, No 3, p 243-250, 1979. 15 Fig, 31 Ref.

Descriptors: *Climatology, *Weather data, *Chihuahuan Desert, *Arid lands, *Mapping, Temperature, Precipitation(Atmospheric), Martonne index of ardity, Mexico, Southwest US.

The intent of the present study is to provide an improved regional map of the Chihuahuan Desert based upon a more uniform, consistent and comprehensive system than has been available in the past. Mean annual temperatures and precipitation values are obtained for nearly 800 weather stations in the states of Arizona, New Mexico, Texas, Sonora, Chihuahua, Coshuila, Durango, Zacatecas, San Luis Potosi, Nuevo Leon and Tamaulipas, and classified according to the 1926 Martonne Index of Aridity. Based on an aridity index of $<$ or $=$ to 10 it is indicated that the Chihuahuan Desert covers approximately 350,000 sq km, including 115 weather stations, and possesses striking homogeneity. The mean average indices were found to be 7.9 with mean and median annual temperatues of approximately 18.6C and average annual precipitation of 235 mm. Twelve other delineations of this desert area are mapped here at the same scale due to existence of large areas where data is not available and to make possible a comparison and provide additional basis for the establishment of firm boundaries. (Tickes-Arizona)
W80-02207

WATER RESOURCES OF THE CHEHALIS INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
H. E. Pearson, and G. T. Higgins.
Geological Survey open-file report 77-704, 1979. 56 p, 7 Fig, 2 Plates, 13 Tab, 20 Ref.

Descriptors: *Water resources, *Surface waters, *Groundwater resources, *Water quality, Aquifers, Water wells, Water yield, Water level fluctuations, Lakes, Streamflow, Storm runoff, Floods, Peak discharge, Low flow, Flow rates, Flood frequency, Historic floods, Maximum probable flood, Stage-discharge relations, Washington, *Chehalis Indian Reservation.

Ground water beneath the 6.6-square-mile Chehalis Indian Reservation, Wash., most of which lies on a flood plain, occurs in the alluvial and terrace sand and gravel deposits. Supplies available within the depth zone of water-level fluctuations are estimated to be between 20 and 60 times that being pumped at the time of the 1975 study. Seasonal water-level changes in wells obtained during the study ranged between about 3 and 10 feet and averaged 7 feet, and the average fluctuation of water levels in three oxbow lakes was about 6 feet. Chemical analysis of ground water shows it is suitable for most uses and that to date there are no serious problems of ground-water pollution. Surface-water quality also is considered generally good. Flooding of reservation land by the Chehalis and Black Rivers occurs annually, generally during periods of heavy rainfall in winter. The largest known flood of the Chehalis River, recorded on January 22, 1972, had an estimated discharge of 53,000 cubic feet per second. Flood-frequency analysis indicates that about 70 percent of the reservation would be flooded during a 50-year flood. Low flows generally occur in August and September. The lowest flow of Willamette Creek (the only stream entirely on the reservation) during 1975 was about 0.45 cubic foot per second, recorded in August. (Woodard-USGS).
W80-02242

HURST PHENOMENON AS A PRE-ASYMPTOTIC BEHAVIOR,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. D. Salas, D. C. Boes, V. Yevjevich, and G. G. S. Pegram.
Journal of Hydrology, Vol 44, No 1/2, p 1-15, November 1979. 7 Fig, 3 Tab, 32 Ref. NSF ENG-1736, ENG77-26729.

Descriptors: *Hydrology, *Hydrologic aspects, *Statistical methods, *Stochastic processes, Analytical techniques, Mathematical models, Analysis, Statistical models, Time series analysis, Model studies, Statistics, Simulation analysis, Distribution, Hurst phenomenon.

Interpretation of the Hurst phenomenon has been controversial in statistical hydrology ever since the Hurst publication indicating that the expected rescaled adjusted range of certain geophysical time series apparently does not behave as n to the 0.5 power. One interpretation has been that the expected rescaled range is asymptotically proportion-

al to n to the h power with h greater than 0.50. Another interpretation is that series exhibiting this phenomenon have Hurst slope h greater than 0.50 for small or moderate values of n but still have 0.50 as the asymptotic value. Computer simulations using skewed variables, ARMA (1,1) models and shifting level models, support the interpretation that the Hurst phenomenon is a pre-asymptotic behavior. It was found in these simulations that: (1) skewness has some (but small) effect; (2) certain shifting level models and a suitable ARMA model having the same correlation structure yield a pre-asymptotic behavior of the expected rescaled range, similar to the Hurst phenomenon; and (3) re-analysis of the Hurst data suggests that this range is within the pre-asymptotic or transient region. Departure from normality and the dependence structure of series act, either individually or in combination, to further accentuate the transient behavior inherent to normal independent random variables. (Humphreys-ISWS)
W80-02332

CHEMICAL AND SUSPENDED-SEDIMENT CHARACTERISTICS OF RIVERS OF INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
V. Subramanian.
Journal of Hydrology, Vol 44, No 1/2, p 37-55, November 1979. 12 Fig, 5 Tab, 25 Ref.

Descriptors: *Rivers, *Suspended solids, *Water quality, *Data collections, Chemical properties, Salts, Dissolved solids, Water chemistry, Discharge(Water), Sediment discharge, River basins, Runoff, Cations, Sodium, Potassium, Calcium, Magnesium, Analysis, Chlorine, Bed load, Carbonates, Sulfates, Phosphates, Foreign research, *India.

Based on preliminary investigations, over the period of two years, the chemical quality of the Ganges, Indus, Brahmaputra, Narmada, Tapti, Mahanadi, Godavari, Krishna, Tungabadra, and Cauvery rivers was evaluated. The discharge-weighted composition for Indian rivers was calculated and compared to the world average river water. The total freshwater runoff for the 9 rivers together with that of 40 minor river basins is 168 x 10 to the 10th power cu m/yr, which is about 15% of the global continental water input. The Indian rivers are alkaline and about 25% more concentrated in dissolved salts than the world average. Discharge and downstream variations in the water chemistry for a few selected stations were briefly explained. The range of values for suspended sediments transported by the rivers was shown together with limited seasonal, discharge, and downstream variations. Chemical, sediment and total load have been calculated for Indian rivers, and erosion rates were compared to data for some major world rivers. Indian rivers contribute about 6% of global mass transfer into the world oceans. Of this amount, nearly 5% goes into the Bay of Bengal, and 95% of this material is carried in suspension by the Ganges and Brahmaputra. The chemical data of river waters have been used to predict theoretically the mineral assemblages in carbonate and silicate systems. Preliminary studies, using X-ray diffraction, have been made on the suspended sediments, and the results were compared to theoretical predictions based on water chemistry. It appears that no systematic regional differences are observed in the water chemistry of Indian rivers, and the suspended sediments are typical for monsoonal rivers draining mainly tropical areas. (Humphreys-ISWS)
W80-02400

2B. Precipitation

RECYCLING OF WATER IN THE AMAZON BASIN: AN ISOTOPIC STUDY,
Comissao Nacional de Energia Nuclear, Sao Paulo (Brazil).
For primary bibliographic entry see Field 2A.
W80-02181

MERCURY IN SOUTHERN NEW ENGLAND COASTAL RAINS,
Connecticut Univ., Groton. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W80-02326

THE QUANTITATIVE MEASUREMENT OF FOG AND RIME DEPOSITION USING FOG-GAUGES,
Tornado and Storm Research Organization, Trowbridge (England).
G. T. Meaden.
Weatherwise, Vol 34, No 10, p 384-390, October 1979. 1 Fig, 5 Ref.

Descriptors: *Fog, *Rime, *Precipitation(Atmospheric), *Gages, Instrumentation, Measurement, Equipment, Foreign research, *England.

In some parts of the world, the deposition of atmospheric moisture from fog forms an important fraction of the total seasonal precipitation. In some, indeed, it represents the primary source of all moisture for the flora and fauna. The proposed universal design has a spherical hollow glass prototype which has been in experimental use for three years. Its diameter is 254 mm, which is convenient because it is exactly double that of a standard British raingage. In wet-fog conditions, the catch drips off continuously into a small-necked collecting vessel beneath, and evaporation losses are small. An alternative practical design for a fog-gage consists of a long cylindrical tube, made from tough weather-resistant plastic, with a diameter slightly smaller than that of a raingage so that it can be fitted into the raingage funnel leaving an annular gap a few millimetres wide. The method has the advantage of considerably increasing the cross-sectional area exposed to drifting fog. The chimney fog-gage self-drains more effectively than does a sphere. It is also easier to wipe downwards any drops that may still be on the outside of the gage at the observation hour. This paper demonstrated that the appratus required to measure fog-water is simple and inexpensive and the measuring procedure straightforward, so that international standardisation should present few problems. (Humphreys-ISWS)
W80-02333

ASPECTS OF ARIDITY AND DROUGHT IN THE MONSOON CLIMATE OF SRI LANKA,
Mainz Univ. (Germany, F.R.). Dept. of Geography.
M. Domros.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 1 and 2, p 384-394, January and April 1978. 5 Fig, 2 Tab, 10 Ref.

Descriptors: *Droughts, *Monsoons, *Rainfall, Precipitation(Atmospheric), Distribution patterns, Seasonal, Annual, Analytical techniques, Data processing, Climatology, Meteorology, *Sri Lanka.

Typical of the monsoonal rainfall conditions over Sri Lanka are the remarkable inter-annual and seasonal deficits of water, varying considerably in temporal and spatial aspects. Therefore, both the phenomena of aridity and of drought are of great significance from the point of the general monsoon climate of Sri Lanka. This paper investigated the annual and monthly aridity by using the 'aridity index' of De Martonne Lauer showing the increasing exent of aridity from the S.W. quarter to the N.W./N as well as S.E. of Sri Lanka. On the other hand, drought has been studied by the 'drought index' of Gibbs and Maher underlining a considerable interannual rainfall variability, being expressed by the incidence of heavily drought-stricken years as well as by the occurrence of completely drought-free years. It was pointed out that drought can be called a typical, however irregular and spatially limited, phenomenon in the climate of Sri Lanka. This paper investigated the annual and monthly aridity by using the 'aridity index' of Gibbs and Maher underlining a considerable interannual rainfall variability, being expressed by the incidence of heavily drought-stricken years as well as by the occurrence of completely drought-free years. It was pointed out that drought can be called a typical, however irregular and spatially limited, phenomenon in the climate of Sri Lanka. All observations were based on 30-year rainfall data (1931-1960) of monthly and annual figures. (Sims-ISWS)
W80-02346

DYNAMICS OF OROGRAPHIC RAINFALL,
Meteorological Office, Poona (India).
R. P. Sarker, K. C. Sinha Ray, and U. S. De.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 1 and 2, p 335-348, January and April 1978. 15 Fig, 2 Tab, 10 Ref.

Descriptors: *Rainfall, *Orography, *Model studies, Mathematical models, Distribution patterns, Precipitation(Atmospheric), Monsoons, Atmosphere, Cloud physics, Meteorology, *Orographic rainfall, *India.

A two-dimensional dynamical model for orographic rainfall was developed earlier with particular reference to the Western Ghats. The model assumes a saturated atmosphere with neutral static stability. In this paper this model was applied for some more cases in Western Ghats and also for some cases in Khasi and Jaintia hills. With the model the terrain induced vertical velocities were computed, and these were used to compute rainfall. The computed rainfall distribution agreed well with the observed rainfall distribution both for Western Ghats and Khasi and Jaintia hills during the active monsoon situations. The peak in rainfall distribution was seen to be purely an orographic effect. Some modifications were made in the model for its application during the weak monsoon situations. The results for the various cases were discussed vis-a-vis the different synoptic situations. (Sims-ISWS)
W80-02347

2C. Snow, Ice, and Frost

PATTERNED GROUND ON AN ACTIVE MEDIAL MORAINE, JOTUNHEIMEN, NORWAY,
Edinburgh Univ. (Scotland). Dept. of Geology.
C. K. Ballantyne.
Journal of Glaciology, Vol 22, No 87, p 396-401, 1979. 8 Fig, 4 Ref.

Descriptors: *Glaciers, *Glacial soils, *Glacial drift, Rocks, Soils, Ice, Particle size, Sediments, Sediment sorting, Glaciology, Medial moraines, Patterned ground.

Sorted circles and nets formed on the surface of the principal medial moraine on Storbreen, Jotunheimen, Norway, were described. These consist of 'islands' of coarse sand, granules, and small pebbles, surrounded by pebbles and cobbles and underlain by small domes of glacier ice. It was suggested that patterned ground formation on the moraine results from differential ablation in areas of thin (less than 200 mm) debris cover near the glacier snout, where melting is relatively rapid. It is unlikely that supraglacial patterned ground could survive deposition. (Sims-ISWS).
W80-02224

ACCELERATING STRAIN PRECEDING AN AVALANCHE,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
R. A. Sommerfeld.
Journal of Glaciology, Vol 22, No 87, p 402-404, 1979. 3 Fig, 1 Ref.

Descriptors: *Avalanches, *Snow, *Strain, Strain gages, On-site investigations, On-site data collections, Measurement, Mountains, Snowpacks, Mechanical properties, Accelerating strain.

Strain gages set in the snow on an avalanche track recorded accelerating strain for four hours preceeding a naturally released avalanche. On a second occasion when the strain-rate was similar, the strain decelerated and no avalanche occured. (Sims-ISWS)

W80-02309

WATER YIELD INCREASES THROUGH SURFACE DUSTING OF A PERMANENT ICEFIELD,
White River National Forest, Glenwood Springs, CO.
R. D. Tarum, and J. R. Meiman.
Water Resources Bulletin, Vol 15, No 5, p 1331-1340, October 1979. 5 Fig, 1 Tab, 14 Ref. Bu. Rec. 14-06-D-6598.

Descriptors: *Snowpacks, *Ablation, *Water yield, Snowmelt, Snow management, On-site investigations, Mountains, Snow, Ice, Snow cover, Glaciers, Albedo, Carbon, Dusts, Watersheds(Basins), Runoff, Streamflow, Icefield ablation, Carbon black, Snow albedo modification, Surface dusting.

Water yields from a permanent ice field were increased by 28% through surface dusting with carbon black. On July 4, 1972, approximately 15 acres of a permanent ice field were treated with 150 lbs. per acre of commercial carbon black. The ice field was located on the eastern slope of the Colorado Front Range at an elevation of 11,500 feet. The carbon black was applied by helicopter using a dry applicator slung below a helicopter. The treatment effect was evaluated by control plot observations of melt and streamflow comparison before and after treatment. The ablation plot studies and runoff comparison with an adjacent watershed both indicated a 28% increase in ablation and meltwater runoff, respectively, for the months of July and August. The study indicated that ice fields could be used as cold-storage reservoirs for use in periods of critical water shortages. (Sim-ISWS)
W80-02358

FORMS AT THE BASE OF TILL STRATA AS INDICATORS OF ICE MOVEMENT,
Geologisches Landesamt, Hamburg, (Germany, F.R.).
J. Ehlers, and H-J. Stephan.
Journal of Glaciology, Vol 22, No 87, p 345-355, 1979. 14 Fig, 8 Ref.

Descriptors: *Ice, *Glaciology, *Glacial drift, *On-site investigations, Movement, Till, Stratigraphy, Geomorphology, Shape, Analytical techniques, Erosion, Glacial sediments, Distribution patterns, Ribs, Flutes.

The direction of inland ice movement, in some cases, can be reconstructed by a study of the forms at the base of till strata. These forms are 'ribs' which are formed either as slickensides or as a type of negative 'flute'; 'edges' and 'wedges', which are caused by shearing movements at the base of the ice; or 'undulations', probably created by restricting moements at the base of the ice. These forms appear to be elongated in the direction of ice movement. As these features can easily be measured, they can be used to check, to supplement, or to replace the results of till-fabric measurements. (Humphreys-ISWS)
W80-02360

RECONSTRUCTED PLEISTOCENE ICE-SHEET TEMPERATURES AND GLACIAL EROSION IN NORTHERN SCOTLAND,
Saint Andrews Univ. (Scotland). Dept. of Geography.
J. E. Gordon.
Journal of Glaciology, Vol 22, No 87, p 331-344, 1979. 5 Fig, 2 Tab, 51 Ref.

Descriptors: *Glaciology, *Ice, *Geomorphology, *Analytical techniques, Temperature, Pleistocene epoch, Mathematical models, Model studies, Analysis, Heat flow, Surfaces, Profiles, *Scotland, Ice-sheet, Ice thickness, Accumulation rates.

Pleistocene ice-sheet temperatures were reconstructed for a west-to-east transect across northern Scotland at the ice maximum using a temperature-profile model. Basal freezing was predicted for the central area of the ice sheet and for zones of basal melting on each side to the west and east. Variations in estimates of annual accumulation rate and ice thickness do not greatly alter this general pattern. However, small errors in estimating mean annual temperature at the ice edge and ice-surface temperature lapse-rate may significantly change the pattern of predicted basal temperature regimes, and basal freezing may have extended over the whole of the area considered. Zones of areal scouring occur in both the west and east of the transect, but are absent from the central mountain area. Under some of the temperature conditions modelled, there is a partial spatial coincidence of the areal scouring in the west with predicted areas of basal melting, but almost none in the east. Possibly this is explained because glacial erosion relates to time periods other than the ice maximum. The focus of this study on trying to link glacier theory and geomorphology has raised new questions and problems, and may offer a productive line of approach to understanding the complex form-process relationships in formerly glaciated areas. Computer simulation of the continuous buildup and decay of former ice sheets offers possibilities and may overcome the problems of attempting to correlate 'static' landform patterns in the present landscape with dynamic glaciological conditions and processes. (Humphreys-ISWS)
W80-02361

SOME RESULTS FROM A LINEAR-VISCOUS MODEL OF THE ARCTIC ICE COVER,
Army Terrestrial Sciences Center, Hanover, NH.
W. D. Hibler, III, and W. B. Tucker, III.
Journal of Glaciology, Vol 22, No 87, p 293-304, 1979. 8 Fig, 3 Tab, 12 Ref. NOAA 04-3-0022-33.

Descriptors: *Ice cover, *Sea ice, *Movement, *Forecasting, *Arctic, Mathematical models, Viscosity, Drag, Winds, Currents(Water), Ocean currents, Ice, On-site data collections, Equations, Stress, Atmospheric pressure, Analytical techniques.

In order to assess the effect of non-local stress transferral through the ice cover empirically, a linear viscous model (employing both bulk and shear viscosities) was used to predict drift-rates for one Soviet and two U.S. drifting stations over the time period May 1962 to April 1964. The predictions, based on available atmospheric pressure and ocean-current data, were compared to free-drift results and to observed values. The empirical viscosity values giving the best fit to observations showed a pronounced seasonal variation that correlated well with the growth rate of thin ice. Drift predictions, especially long-term net drift results, showed drift magnitudes and turning angles to be simulated significantly better by a viscous model than by a free-drift model. The effects of steady currents were shown to be small for velocities averaged over days but were significant for averages over years. (Sims-ISWS)
W80-02362

IS VERTICAL SHEAR IN AN ICE SHELF NEGLIBIBLE,
British Antarctic Survey, Cambridge (England).
T. J. O. Sanderson, and C. S. M. Doake.
Journal of Glaciology, Vol 22, No 87, p 285-292, 1979. 3 Fig, 11 Ref.

Descriptors: *Glaciers, *Shear stress, *Movement, *Model studies, Mathematical models, Stress, Shear, Equations, Mechanical properties, Physical properties, Glaciology, *Erebus Glacier, *Amery Ice Shelf, Glacial mechanics.

Vertical shear stress in ice shelves cannot be precisely zero since the upper and lower surfaces are generally not parallel. By performing stress balance on a vertical column in an ice shelf, the magnitude was calculated. This was done for an unconfined glacier tongue and for a confined bay ice shelf; first, using the assumption of constant temperature and density with depth, and second, using realistic data and profiles for Erebus Glacier tongue and for the Amery Ice Shelf. Shear stresses increase almost linearly with depth and are proportional to surface slope. For Erebus Glacier tongue, the shear stress is at most 5% of the magnitude of the direct stress deviators, and its action through the ice shelf should result in differential movement of 1.8 cm/a between the top and bottom of the ice shelf. For the Amery Ice Shelf, the shear stress is at most 0.4% of the magnitude of the direct stress deviators, and this should lead to differential movement of 2.5 cm/a between the top and the bottom of the ice shelf. Shear stresses, therefore, are generally negligible in comparison with direct stress deviators and can be ignored when considering the overall dynamics of ice shelves. Differential movement is unlikely to be detectable. (Sims-ISWS)
W80-02363

SUPRAGLACIAL DEBRIS OF G2 GLACIER IN HIDDEN VALLEY, MUKUT HIMAL, NEPAL,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
M. Nakawo.
Journal of Glaciology, Vol 22, No 87, p 273-283, 1979. 8 Fig, 2 Tab, 26 Ref.

Descriptors: *Glaciers, *Glacial sediments, *Particle size, *Distribution patterns, Glacial drift, Erosion, Sedimentation, Sediments, Sampling, On-site data collections, Ice, Melt water, Mountains, Glaciology, *Nepal, *Himalaya mountains, *Hidden Valley(Nepal), Debris, Glacial debris, Supreaglacial debris.

Field investigations of supraglacial debris were carried out during the monsoon season in 1974 on G2 glacier near Tukche Peak ibn Hidden Valley, Mukut Himal, Nepal. The thickness of the debris layer was observed to increase down-glacier. Laboratory analysis, however, showed a decrease in particle size in the same direction. This decrease was explained in terms of mixing of particles contained in glacier ice with the original debris as melting proceeds. A simple relation between debris mass and glacier flow was introduced to explain the observed results. (Sims-ISWS)
W80-02364

ON THE COMPUTATION OF HEAT TRANSFER COEFFICIENTS FROM ENERGY-BALANCE GRADIENTS ON A GLACIER,
Innabruck Univ. (Austria). Inst fuer Meteorologie und Geophysik.
M. Kuhn.
Journal of Glaciology, Vol 22, No 87, p 263-272, 1979. 4 Tab, 29 Ref.

Descriptors: *Heat transfer, *Glaciers, *Mathematical models, *Surfaces, Ice, Energy budget, Analysis, Analytical techniques, Heat flow, Turbulent flow, Boundary processes, Melting, Temperature, Ablation, Boundaries(Surfaces), Air-ice interfaces, Sensible heat, Energy balance, Heat transfer coefficients.

The turbulent flux of sensible heat in the energy balance of a glacier surface was assumed to be proportional to the temperature difference between the glacier surface and the atmosphere at the same level but outside the thermal influence of the glacier. The factor of proportionality between them was explained in terms of friction velocity, roughness height, and stability function of the logarithmic wind and temperature profile. It was then derived from climatological records and measurements of the energy balance and its altitudinal gradients at Hintereisferner. Examples of the energy-balance and its altitudinal gardients at Hintereisferner. Examples of the energy-balance components and their change with altitude were given for the entire ablation season as well as for short periods. The heat transfer coefficients derived have a mean value of 1.7 plus or minus 0.2 MJ/sq m/d/K. (Humphreys-ISWS)
W80-02365

RHOMBUS AND RHOMBOID PARALLELOGRAM PATTERNS ON GLACIERS: NATURAL INDICATORS OF STRAIN,
Georgia State Univ., Atlanta. Dept. of Geology.
C. J. Waag, and K. Echelmeyer.
Journal of Glaciology, Vol 22, No 87, p 247-261, 1979. 8 Fig, 4 Tab, 11 Ref.

Descriptors: *Glaciers, *On-site investigations, *Strain, *Alaska, Ice, On-site tests, Measurement, Distribution patterns, Strain measurement, Analytical techniques, Shape, Cracks, Maps, Crystallography, Crystals, Stress analysis, Firn, Parallelogram patterns, Strain rates.

Subtle rhombus and rhomboid parallelogram patterns occur on Vaughan Lewis Glacier and the Gilkey Glacier System, Juneau Icefield, Alaska. The patterns are within the firn at the firn-ice interface, are formed by differential recrystallization within narrow preferred zones, and are apparently manifestations of stresses transferred upward from the glacier ice. On the glaciers of the Gilkey System the patterns occur where intense lateral shortening is indicated by abrupt convergence of medial moraines and an abundance of extension crevasses. The short axes of the rhombi and the obtuse angle bisectors of the rhomboids are subparallel to the strike of extension crevasses, and therefore to the axis of shortening. The long axes of the rhombi and the acute angle bisectors of the rhomboids are parallel to the foliation and ice-flow direction. The angles of the parallelograms are variable locally, but average 105 deg and 75 deg; the variation seems to reflect intensity and duration of stress. Similar parallelograms occur within the troughs of wave bulges below the Vaughan Lewis Icefall. In the wave bulges, the foliation arcs parallel the wave. The long axes of the rhombi and acute angle bisectors of the rhomboids parallel the foliation around the foliation arc. The short axes of the rhombi and the obtuse angle bisectors of the rhomboids parallel the strikes of radial crevasses, are perpendicular to the direction of extension, and form a fan divergent downstream. The precise mechanisms and conditions of formation of the parallelograms are not yet understood. Preliminary strain-rate measurements suggest, however, that correlations exist between the orientations of the principal strain-rates and the axes of the patterns, and between the magnitude of the strain-rates and the axial lengths of the patterns. (Humphreys-ISWS)
W80-02366

2D. Evaporation and Transpiration

EXPERIMENTAL INVESTIGATION OF EVAPOTRANSPIRATION,
Minnesota Univ., St. Paul. Dept of Soil Science.
J. E. Ljungkull, D. G. Baker, and J. B. Swan.
In: American Meteorological Society, Fourteenth Conference on Agriculture and Forest Meteorology and Fourth Conference on Biometeorology, extended abstracts, p 169. American Meteorological Society, Boston, 1979. OWRT B-147-MINN (1) 14-34-0001-9119.

Descriptors: *Evapotranspiration, *Measurement, *Lysimeters, *Analytical techniques, Water utilization, Land use, Microclimatology, *St. Paul, MN.

Evapotranspiration is one element in the hydrologic cycle which is not measured on a routine basis anywhere in the North Central Region except St. Paul, Minnesota. The recently installed weighing lysimeter at the microclimatological station on the St. Paul Campus of the University of Minnesota allows precise, short term measurements of evapotranspiration to be made. Simultaneous measurement of other climatic variables provide the data for the formulas frequently used to estimate evapotranspiration. During the summer of 1978 data was taken from June 9 through October 10. Preliminary statistical analysis of the data indicated that during this period pan evaporation was a good predictor of evapotranspiration, accounting for about 88 percent of the variation in the measured evapotranspiration. (Blake-Minn)
W80-02051

RECYCLING OF WATER IN THE AMAZON BASIN: AN ISOTOPIC STUDY,
Comissao Nacional de Energia Nuclear, Sao Paulo (Brazil).
For primary bibliographic entry see Field 2A.
W80-02181

DAYTIME ENERGY EXCHANGE AND EVAPORATION FROM A WOODED SWAMP,
Toronto Univ. (Ontario). Dept. of Geography.
D. S. Munro.
Water Resources Research, Vol 1 5, No 5, p 1259-1265, October 1979. 3 Fig, 2 Tab, 22 Ref.

Descriptors: *Evaporation, *Energy loss, *Canada, Energy transfer, Equilibrium, Swamps, Moisture, Soils, Vegetation effects, Micrometeorology, *Energy exchange, *Ontario(Canada), *Energy balance, Wooded swamps, Bowen ratio.

Hourly values of daytime energy balance components were obtained for 5 days in late summer at a wooded swamp in southern Ontario. Bowen ratio estimates of the energy used in evaporation were compared with values obtained from the equilibrium form of the combination model. Agreement between the two methods was found to be poor for hourly values, but better in the case of daytime totals, where the proportion of Bowen ratio to equilibrium estimates varied from 0.7 to 1.04. The results did not support the use of a potential evaporation formula despite an apparently nonlimiting supply of moisture in the soil. There was some support in the findings for the existence of an equilibrium evaporation regime. An equilibrium evaporation regime implies that vegetative control can be ignored in long-term evaporation work. If true, such a regime could simplify the task of estimating water loss from a swamp. (Roberts-ISWS) t the amount of organic polluants being dumped into rivers in order to safeguard the life, quality and productivity of the fish existing in the river. (Deal-EIS)
W80-02182

CHARACTERIZATION OF ARID CLIMATES ACCORDING TO COMBINED WATER BALANCE PARAMETERS,
California Univ., Berkeley. Dept. of Geography.
T. M. Oberlander.
Journal of Arid Environments, Vol 2, p 219-241, 1979. 6 Fig, 1 Tab, 27 Ref.

Descriptors: *Climatic zones, *Weather data, *Arid climates, *Water balance, Moisture regime, Soil moisture, Potential evapotranspiration, Thornthwaite's Aridity Index.

An attempt is made here to devise an extended characterization of the climates rather than the actual moisture regime as conditioned by local edaphic factors at individual sites. A supplementary water balance index is proposed with the objectives of determining the nature of climatic conditions in the dry realm, discovering true climatic analogies in widely separated locations, and devising a means of categorizing and comparing climates numerically without cumbersome manipulative procedures. Positive values of this index make distinctions between climates permitting soil moisture storage, while negative values differentiate between climates producing year-round moisture deficit. Graphic plots are presented of potential evapotranspiration and Thornthwaite's Aridity Index as well as of this water balance index to facilitate the recognition of true arid region climatic analogies and permit precise characterization of the climates of different arid regions. It is hoped that these results will be useful to investigators of diverse aspects of arid environments. (Tickes-Arizona)
W80-02208

2E. Streamflow and Runoff

FLOOD PLAIN INFORMATION: KUSKOKWIM RIVER, MCGRATH, ALASKA.
Army Engineer District, Anchorage, AK.
Prepared for City of McGrath, Alaska, September 1977. 18 p, 9 Fig, 9 Plates, 1 Tab.

Descriptors: *Alaska, *Flooding, *Flood frequency, *Flow characteristics, *Ice jams, *Kuskokwim River(AK), *McGrath(AK), Floods, Indirect flood measurement, Maximum probable flood, Flood forecasting, Historic floods, Flood data, Flood stages, Peak discharge, Flood peak, Flow duration, Rivers, Flood protection, Warning systems, Crooked Creek(AK), 100-year flood, 500-year flood.

The study area encompasses the Kuskokwim River flood plain surrounding the city of McGrath, Alaska. The lands in the study area are primarily settled on the left bank of the Kuskokwim River in and around the City of McGrath with both residential and commercial structures. Several residential buildings also exist on the right bank of the river. There are no bridges or other man-made obstructions on the Kuskokwim River within the study area. There are no existing flood control structures on the Kuskokwim River. Flood data were obtained from two U.S. Geological Survey stream gages and interviews with long-term residents. Flooding in the study area generally occurs in mid-May, caused by ice jams. Fall flooding has occurred due to intense rains during August and September. The greatest recorded flood occurred on May 18, 1972 and was caused by an ice jam downstream of McGrath. A water surface elevation of 337.9 feet above mean sea level was reported. The 100-year flood would have a peak flow of 110,000 cubic feet per second (cfs), with an elevation of 337.7 feet mean sea level (msl), while the 500-year flood would have a peak discharge of 143,000 cfs and an elevation of 339.6 feet msl. Potential ice jam floods pose serious flood hazards, and the estimate for such floods is an elevation of 339.0 feet msl. This report has been prepared because a knowledge of flood potential and flood hazards is important in land use planning and for management. (Coan-NC)
W80-02014

FLOOD PLAIN INFORMATION: DRY CREEK, BOULDER COUNTY-WELD COUNTY, COLORADO.
Army Engineer District, Omaha, NE.
Prepared for Boulder County and Weld County, Colorado, and Colorado Water Conservation Board, June 1978. 28 p, 16 Fig, 33 Plates, 3 Tab.

Descriptors: *Colorado, *Flooding, *Flood profiles, *Peak discharge, *Flood plains, *Weld County(CO), *Boulder County(CO), *Dry Creek(CO), 100-year flood, 500-year flood, Floods, Indirect flood measurement, Storms, Cloudbursts, Historic floods, Flood data, Flood frequency, Flood stages, Flow duration, Flow characteristics, Rivers, Flood protection, Non-structural alternatives, Flood plain zoning, Warning systems, Reservoirs.

The study area is the flood plain of Dry Creek extending from Boulder Reservoir in Eastern Boulder County to the confluence of Dry Creek and St. Vrain Creek in southwestern Weld County. Development within the flood plain is relatively sparse consisting mainly of agricultural lands. Flood data were obtained from flood records, topographic maps, and aerial photographs. There are no flood control structures as such, but many irrigation reservoirs provide incidental flood protection. Floods in the study area generally occur from May through September and result from very intense rainfall of cloudburst magnitude. No stream gaging stations were located on Dry Creek which have recorded past flood peak discharges. Because of the rural nature of the study area, little information is available on historic flooding. The peak discharge for the 100-year flood is estimated to be 2,700 cubic feet per second (cfs), with an elevation of 5003.1 feet mean sea level (msl). For the 500-year flood, the peak discharge would be 4,495 cfs, with an elevation of 5003.8 feet msl. This report provides a suitable basis for the adoption of land use controls to guide flood plain development with consideration for environmental attributes. (Coan-NC)
W80-02015

FLOOD PLAIN INFORMATION: SHREVEPORT, LOUISIANA, NO. 2, BRUSH BAYOU AND TRIBUTARIES.
Army Engineer District, New Orleans, LA.
Prepared for the City of Shreveport, LA, February 1974. 34 p, 23 Fig, 34 Plates, 9 Tab.

Descriptors: *Louisiana, *Flooding, *Flood profiles, *Peak discharge, *Brush Bayou(LA), *Shreveport(LA), Floods, Indirect flood measurement, Flood forecasting, Historic floods, Flood data, Flood stages, Flood peak, Flow duration, Flor characteristics, Flood damage, Stream erosion, Flood protection, Warning systems, Control structures, Channel improvement, Standard project flood, Intermediate regional flood.

The study area includes the city of Shreveport and surrounding area located in the flood plains of Brush Bayou. Development in the flood plains is primarily residential but includes commercial and industrial mixes. Flood data were obtained from U.S. Geological Survey gaging and precipitation stations, newspaper files, historical documents and interviews with local residents. Major floods occur in the study area during all seasons, but appear most frequently during summer and fall. These floods result from heavy rainfall and occasionally from hurricane activity. Channel alterations are the only flood damage reduction measures completed in the area. The worst recorded flood occurred July 25, 1933 but no recorded discharge exists. In March 1969 a major flood discharged 2,020 cubic feet per second (cfs), rising to 167 feet mean sea level datum (msd), measured at Mt. Zion Bridge on Brush Bayou. Other large floods occurred in 1968, 1969, 1970, 1971, and 1972. The Intermediate Regional Flood occurring in the lower limit of the study area would have a peak discharge of 12,760 cfs, reaching a height of 6.2 feet and remaining 7 hours above bankfull stage. The Standard Project Flood at the lower limit of the study area would discharge 23,370 cfs and reach a height of rise of 11.3 feet. This report provides a suitable basis for the adoption of land use controls to guide flood plain development. (Coan-NC)
W80-02016

FLOOD PLAIN INFORMATION: PEARL RIVER, BOGUE LUSA AND COBURN CREEKS VICINITY OF BOGALUSA, LA.
Army Engineer District, Mobile, AL.
Prepared for The City of Bogalusa, LA, June 1973. 24 p, 5 Fig, 13 Plates, 11 Tab.

Descriptors: *Louisiana, *Flooding, *Flood data, *Peak discharge, *Bogue Lusa Creek(LA), *Coburn Creek(LA), *Pearl Creek(LA), Floods, Indirect flood measurement, Flood profiles, Historic floods, Flood frequency, Flood recurrence interval, Flood stages, Flood peak, Flow duration, Standard Project Flood, Flood protection, Warning systems, Bogalusa(LA), Intermediate Regional Flood.

The study area includes land in the vicinity of Bogalusa, Louisiana and located in the flood plains of Bogue Lusa Creek, Coburn Creek, and Pearl River. The flood plains of Bogue Lusa Creek and Coburn Creek are primarily residential while that of Pearl River includes considerable commercial development. Flood data were obtained from U.S. Geological Survey stream gaging stations, U.S. Soil Conservation Service maps, newspaper files and interviews. The main flood season is in winter and spring but flooding may occur at any time of the year. There are no existing or proposed flood control measures on Bogue Lusa or Coburn Creeks or Pearl River. The worst recorded floods on Bogue Lusa Creek, Coburn Creek, and Pearl River reached peak discharges of 24,800 cubic feet per second (cfs) on November 14, 1961, 5,600 cfs on November 14, 1961, and 88,200 cfs on February 23, 1961, respectively. The Intermediate Regional Flood (IRF) on Bogue Lusa Creek near the State Highway 21 Bridge would have a peak discharge of 39,800 cfs, while the Standard Project Flood (SPF) would reach 60,000 cfs. On Coburn Creek at the State Highway 21 Bridge, the peak discharge for the IRF would be 9,200 cfs and for the SPF, 13,300 cfs. The IRF on Pearl River would have a peak discharge of 145,000 cfs and the SPF would discharge 285,000 cfs. This report is intended to provide a suitable basis for adopting land use controls to guide flood plain development and aid in identifying other flood damage reduction techniques. (Coan-NC)
W80-02017

FLOOD PLAIN INFORMATION: UPPER WHITE ROCK CREEK, PLANO, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for the City of Plano, Texas, May 1974. 34 p, 9 Fig, 12 Plates, 6 Tab.

Descriptors: *Texas, *Flooding, *Flood data, *Flood frequency, *Plano(TX), *Upper White Rock Creek(TX), Floods, Indirect flood measurement, Flood forecasting, Flood profiles, Historic floods, Flood recurrence interval, Flood stages, Flood peak, Flow duration, Stage-discharge relations, Flood protection, Warning systems, Standard Project Flood, Dallas(TX), Intermediate Regional Flood.

The study area covered in this report is the Upper White Rock Creek flood plain within and around the city of Plano, Texas. Little development exists in the flood plain but the city of Plano is expected to grow rapidly in the upcoming years. Data were collected from U.S. Geological Survey reports, a stream gage at Keller Springs Road, Texas Highway Department files, newspaper files, interviews with local residents and field investigations. There are no flood damage prevention measures in the study area at this time. The major floods occurring in the study area are produced by heavy rainfall from frontal type storms, usually in the spring and summer months. Localized thunderstorms of intense rainfall may also cause flooding at any time of the year. The highest known flood occurred on September 21, 1964, with a peak discharge of 37,900 cubic feet per second (cfs), reaching a gage height elevation of 574.5 feet. At Keller Springs Road, the Intermediate Regional Flood would discharge 30,800 cfs while the Standard Project Flood would discharge 53,200 cfs. The main purpose of this report is to provide guidance for intelligent land use in the upper White Rock Creek area. The report details regulatory measures to minimize damage from flooding, including flood plain zoning ordinances, building codes, structural measures, flood insurance and others. (Coan-NC)
W80-02019

FLOOD PLAIN INFORMATION: MARINE CREEK, FORT WORTH, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for the City of Fort Worth, TX. September 1974. 34 p, 8 Fig, 10 Plates, 5 Tab.

Descriptors: *Texas, *Flooding, *Flood profiles, *Flood data, *Peak discharge, *Fort Worth(TX), *Marine Creek(TX), Floods, Indirect flood measurement, Flood forecasting, Historic floods, Flood frequency, Flood stages, Flood peak, Standard project flood, Flood protection, Warning systems, Dams, Channel improvement, Intermediate Regional Flood.

The study area is the Marine Creek flood plain in the vicinity of Fort Worth, Texas. The area encompasses about 9.4 miles of channel. The upper portion of the floodplain is mainly rural in nature except for occasional scattered pockets of residential, commercial, and industrial development along the highways and roads serving the area. The area of the flood plain below Marine Creek Lake is highly urbanized. Flood data were gathered from historical records and newspaper files; there are no operating stream gaging stations on Marine Creek. At present, there are two flood control structures in the watershed, Marine Creek Dam and Cement Creek Dam. Most of the flooding occurs during the spring and fall resulting from prolonged or successive storms that produce heavy rainfall. The worst recorded floods were a series of three different floods occurring during the week of 19 April, 1942. There was no information available on the peak discharges. The maximum known discharge on streams in the region of Marine Creek occurred in September 1964, discharging 38,100 cubic feet per second (cfs) on White Rock Creek. The Intermediate Regional Flood (IRF) for Marine Creek would have a peak discharge of 12,800 cfs above Main Street, reaching a height of rise above bankfull stage of 3.2 feet, and lasting for 1.1 hours. The Standard Project Flood (SPF) would have a peak discharge of 19,800 cfs, reach a height of rise of 6.6 feet above bankfull stage, and last for 2.9 hours. This report is intended to provide appropriate governmental bodies with data to aid in planning the best use of flood prone lands or contribute to the solution of local flood problems. (Coan-NC)
W80-02020

FLOOD PLAIN INFORMATION: PARTS I AND II: TAOS COUNTY - NEW MEXICO.
Army Engineer District, Albuquerque, NM.
Prepared for The City and County of Taos, NM, June 1977. 27 p, 3 Fig, 54 Plates, 5 Tab.

Descriptors: *New Mexico, *Flooding, *Flood profiles, *Flood data, *Peak discharge, *Taos(NM), *Taos County(NM), Floods, Indirect flood measurement, Maximum probable flood, Historic floods, Flood stages, Flood peak, Flow duration, Stage-discharge relations, Flood protection, Warning systems, Control structures, Rio Fernando de Taos(NM), 100-year flood, 500-year flood.

The study area includes the Rio Fernando de Taos River flood plain and the flood plains of its tributaries near Taos, New Mexico. Developments in the flood plains consist primarily of agricultural land; there is no residential and commercial development in the flood plain. Flood data were obtained from stream gaging stations, topographic maps, historical records, newspaper files, and interviews with local residents. The Las Cruces Arroyo Floodwater retarding structure is the only structure in the study area controlling floodflow. No other flood control projects have been authorized. Major flood-producing storms are most likely to occur during the transitional periods between spring and summer, and summer and fall. Precipitation usually occurs from thunderstorm activity caused by intermittent inflow of tropical Gulf air. Not much information is available on historic floods and no estimates of discharge or worst floods are made. The peak discharge for the 100-year flood is estimated to be 1,000 cubic feet per second (cfs), reaching a height of rise of 1.6 feet at the Grant Boundary Line. The 500-year flood would have a peak discharge of 1,600 cfs, with a height of rise of 2.1 feet, occurring at the mouth of the Rio Fernando de Taos River. This report will aid in the development of flood damage reduction techniques, land use planning of flood plains, and an Overall Flood Plain Management (FPM) program. (Coan-NC)
W80-02021

FLOOD HAZARD ANALYSES: NORTH FORK - NEW RIVER, ASHE COUNTY, NORTH CAROLINA.
Soil Conservation Service, Raleigh, NC.
Prepared for Ashe County, NC, May 1979. 11 p, 1 Fig, 1 Plate, 2 Tab, 8 Append.

Descriptors: *North Carolina, *Floods, *Flooding, *Flood flow, *Indirect flood measurement, *Flood profiles, *Storms, *Hurricanes, *Flood stages, *Peak discharge, *Flood peak, *Ashe County(NC), *North Fork-New River(NC), *New River(NC), Historic floods, Flood data, Rivers, Floodways, Flood plains, Flood plain management, Flood protection, Non-structural alternatives, Flood plain insurance, 100-year flood, 500-year flood.

This report studies the flood hazard in Ashe County, NC, and focuses on the North Fork-New River. Separate reports were prepared for South Fork-New River and Beaver and Naked Creeks. The North Fork-New River joins with the South Fork-New River at the Ashe-Alleghany County line to become the New River which becomes the Kanawha River in West Virginia and flows into the Ohio River. The study area is characterized by numerous mountains with rolling country between the mountains. The North Fork-New River has a drainage area of 289 square miles at its confluence with the South Fork-New River. In the 50.6 mile length of the North Fork 1,948 acres and 2,385 acres are inundated by the 100- and 500-year floods, respectively. Development in the floodplain is primarily rural homes. Flooding is caused by locally intense thunderstorms and hurricanes and occurs throughout the year. Historical flood records show the August 1940 flood was the larg-

est since 1908 when stream gage records were started. This flood was greater than the projected 100-year flood. The most recent flood occurred in 1978 and approached the 100-year flood. For the 100-year flood, discharges would range from 2,160 cubic feet per second (cfs) to 36,242 cfs at different cross sections, and the maximum elevation would reach 3,330 feet mean sea level (msl). For the 500-year flood, discharges would range from 4,018 cfs to 67,410 cfs, with a maximum elevation of 3,331 msl. Ashe County has no floodplain regulations, nor has it established structural flood control measures, but it does participate in the national flood insurance program. A flood plain management program is recommended for the County. (Iervolino-NC)
W80-02030

FLOOD HAZARD ANALYSES: ARARAT RIVER, SURRY COUNTY, NORTH CAROLINA.
Soil Conservation Service, Raleigh, NC.
Prepared for Surry County, NC, April 1979. 13 p, 1 Fig, 1 Plate, 1 Tab, 8 Append.

Descriptors: *North Carolina, *Floods, *Flooding, *Flood flow, *Indirect flood measurement, *Flood profiles, *Storms, *Hurricanes, *Surry County(NC), *Mt Airy(NC), *Ararat River(NC), Historic floods, Flood data, Flood stages, Flood peak, Rivers, Floodways, Flood plains, Flood plain management, Flood protection, Non-structural alternatives, Flood plain insurance, Building codes, Zoning, 100-year flood, 500-year flood, Stewarts Creek(NC), Lovills Creek(NC).

This report is the second part of the flood hazard analysis for Surry County, NC, in the vicinity of Mt. Airy. The study area is the flood plain of a 9.5 stretch of the Ararat River which is a tributary to the Yadkin River. The drainage area of the Ararat River is 36 square miles plus 151 square mile drainage area of two of its tributaries--Stewarts and Lovills Creeks. Development in the flood plain is limited residential and commercial where the state road system crosses the flood plain. The Ararat flood plain is located in the Piedmont Plateau of the state and is characterized by hills, narrow ridges and low knobs. Flooding is caused by locally intense thunderstorms, general large area storms and hurricanes throughout the year. The largest flood occurred on June 14, 1947 and as recorded by stream gages was greater than the 100-year flood. In 1975 there were six flood events recorded at the Ararat stream gage; the largest occurred on Sept. 4 and equalled the two-year event. In a 100-year flood 562 acres would be flooded to a maximum elevation of 1,094.7 feet mean sea level (msl). The maximum elevation for the 500-year flood would be 1,096 msl, with 665 acres flooded. Mt. Airy in 1974 became elegible for flood insurance but Surry County is still not in the program. Flood plain management techniques are described, both regulatory measures such as flood plain regulations, land use restrictions and flood insurance, and corrective measures such as land treatments, stream improvements, floodwalls or levees and warning systems. (Iervolino-NC)
W80-02031

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX IX-FLOOD CONTROL.
California Region Framework Study Committee.
For primary bibliographic entry see Field 4A.
W80-02034

A NEW COLLOCATION METHOD FOR THE SOLUTION OF THE CONVECTION-DOMINATED TRANSPORT EQUATION,
Princeton Univ., NJ. Dept. of Civil Engineering.
G. E. Pinder, and A. Shapiro.
Water Resources Research, Vol 15, No 5, p 1177-1182, October 1979. 7 Fig, 4 Ref.

Descriptors: *Model studies, *Mathematical models, *Analytical techniques, Flow, Convection, Mass transfer, Diffusion, Equations, Functions, Mathematics, Methodology, Transport equations, Collocation methods.

A modified Hermitian basis function was developed as a means of enhancing numerical solutions to the convection-dominated transport equation using orthogonal collocation. An asymmetric approximation to the first-order spatial derivative was provided so that oscillations in the numerical solution were eliminated while introducing a minimum amount of numerical dispersion. The degree of assymetry in the basis function required to achieve a smooth solution was shown to be dependent upon the magnitude of the convective and dispersive terms. (Sims-ISWS)
W80-02177

SYNTHETIC HYDROLOGIC INFORMATION--A CASE STUDY,
Illinois State Water Survey, Urbana.
K. P. Singh.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY10, Proceedings Paper 14922, p 1257-1275, October 1979. 4 Fig, 7 Tab, 11 Ref, 2 Append.

Descriptors: *Flood control, *Hydrologic data, *Illinois, Model studies, Lakes, Maximum probable flood, Navigation, Reservoir operation, Synthetic hydrology, Water resources, Water supply, Hydrology, *Lake Carlyle(IL), *Lake Shelbyville(IL).

Methodologies were developed for generating synthetic hydrologic information in respect to weekly flows, precipitation on and evaporation from the lake surfaces, and navigation flow requirements to investigate: (1) the range of response with the optimal joint operation (derived with the historical data) of the Shelbyville and Carlyle Lakes in Illinois, and (2) any desirable improvements in operation. A two-distribution model was shown to be better than the Pearson or normal distribution model for generating monthly streamflows. A method for filtering outliers was predicated on the basis of hydrometeorology and rainfall-runoff phenomenon. A disaggregation procedure was formulated for converting monthly flows to weekly flows. Markov models were used successfully in generating monthly precipitation on and evaporation from the lake surfaces. The weekly navigation-flow requirements were simulated by a third-order Markov chain. (Lee-ISWS)
W80-02185

MISSISSIPPI RIVER SHOALING: A DIAGNOSTIC STUDY,
Iowa Univ., Iowa City, Inst. of Hydraulic Research.
T. Nakto, R. M. Baker, and J. F. Kennedy.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY11, Proceedings paper 14978, p 1375-1391, November 1979. 10 Fig, 1 Tab, 14 Ref, 1 Append. DACW-25-76-C-0037.

Descriptors: *Bed load, *Shoals, *Mississippi River, Dredging, On-site data collections, Navigation, Sediment transport, Suspended load, Reach(Streams), *Shoaling, Sediment movement, Sediment input, Empirical relationships, Mean flow velocity, Water discharge, Diagnostic study.

A field study was conducted to collect definitive data on the flow and sediment movement characteristics in the recurrent shoaling reaches of the Mississippi River in the vicinities of Fox Island and Buzzard Island in Pool 20 between Keikup, Iowa, and Canton, Missouri. Detailed field data were used to identify the source of the excess sediment input into the Mississippi River and to elucidate the principal mechanisms of shoaling processes in the study areas by establishing empirical relationships of the bed load discharge and the suspended load discharge with the mean flow velocity and the water discharge. (Roberts-ISWS)
W80-02186

GENERALIZED DISTRIBUTION OF TURBULENT DIFFUSIVITY,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
J. C. Willis.
Journal of Hydraulic Research, Vol 17, No 3, p 231-250, 1979. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Diffusivity, *Mathematical models, *Open channel flow, *Turbulent flow, Mathematical studies, Model studies, Velocity, Distribution, Theoretical analysis, Analytical techniques, Equations, Suspended solids, Flow, Eddy viscosity, Diffusivity distribution, Sediment concentration, Error function.

Derivations of distributions of diffusivity, flow velocity, and sediment concentration over the flow depth were made for a generalized normalization of the relative distance from the floow boundary. Boundary condition restraints suggest a normalization function with a finite lower limit and an infinite upper limit. In analytical considerations, the distribution functions were discussed relative to an unspecified mean turbulent diffusivity. An analysis of the distributions was made in terms of their limits at the channel boundary and the free surface (or top of the boundary layer). The analytical developments were then applied to three models that have been used previously. Besides the parabolic and error function distributions of diffusivity, an expression for the diffusivity distribution was derived from the power function model for the velocity distribution. A numerical solution for the concentration distribution was made based on this diffusivity distribution. Two new normalization unction were investigated in some detail. These were the Rayleigh function and the gamma function. Of the models investigated herein, the gamma function offers the greatest promise as a generally applicable model for turbulent diffusivity. If appropriate parameters are selected, it satisfies both boundary conditions on the velocity and is asymtotic to the error function, which also satisfies the velocity-slope boundary condition at the water surface. Any normalized probability function was shown to be expressible as a potential model for the turbulent diffusivity. A consideration of all available functions is beyond the scope of this paper; however, the analysis procedure used in terms of the functional form and boundary conditions should be generally applicable and should serve as a basis for comparison of potential models. Possibly these concepts will stimulate the development and experimental verification of better diffusivity models for describing fluid flow phenomena. (Humphreys-ISWS)
W80-02192

POTAMOLOGY IN 1932: LOWER MISSISSIPPI RIVER,
Pyburn and Odom, Inc., Baton Rouge, LA.
L. M. Odom.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 105, No WW4, Proceedings Paper 14993, p 405-420, November 1979. 3 Fig, 5 Ref, 1 Append.

Descriptors: *Mississippi River, *Flood control, *Potamology, *Reviews, History, Erosion, Stream erosion, Streamflow, Floods, Sediments, Sediment transport, Sedimentation, Cutoffs, Channel improvement, Navigation, Rivers, Hydraulics.

A review was presented of the knowledge of the science of rivers as it stood in 1932 as described in the Mississippi River Commission Report published that year entitled 'Improvement of the Lower Mississippi River for Flood Control and Navigation'. The conclusions and recommendations given in the report are still in general use by today's designers of river control and maintenance works. While the prime reason for preparing this paper was to make available to younger engineers a summary of the knowledge of potamology contained in this long-out-of-print report, it is also hoped that it will initiate and stimulate analysis. Renewed emphasis is needed for obtaining data from the prototype streams, particularly in view of the late developments in electronic and computerized devices for use in surveying, sampling, and storage and analysis of data. (Sims-ISWS)
W80-02337

FLOOD FREQUENCY ESTIMATES ON ALLUVIAL FANS,

Dames and Moore, Washington, DC.
D. R. Dawdy.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY11, Proceedings Paper 15001, p 1407-1413, November 1979. 1 Tab, 5 Ref, 2 Append.

Descriptors: *Flood frequency, *Mathematical models, *Alluvial fans, *Geomorphology, Model studies, Analytical techniques, Theoretical analysis, Floods, Alluvial channels, Open channel flow, Flood flow, Flood routing, Hydraulic geometry.

A uniform method was presented for the determination of flood flow frequencies on alluvial fans. The method was based on geomorphologic principles, and has general applicability. There are three basic assumptions underlying the proposed method. The first assumes that a oog Pearson III distribution applies to the distriburion of flood flows at the apex. The second basic assumption is that each event forms a single channel and flow remains in that channel throughout the event. The third basic assumption is that flood channels are distributed uniformly across any contour. The concept is basically reasonable, but it ignores the fact that equally valid assumptions concerning placing of channels and placing of centers of channels would result in different probabilities, particularly within one stream width of the edge of an alluvial fan. (Humphreys-ISWS)
W80-02342

DOWNSTREAM EFFECTS OF STORMWATER MANAGEMENT BASINS,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY11, Proceedings Paper 14977, p 1343-1356, November 1979. 5 Fig, 6 Tab, 8 Ref, 1 Append.

Descriptors: *Runoff, *Urban runoff, *Detention reservoirs, *Sediments, Drainage, Storms, Storm runoff, Flood control, Effects, Cities, Urbanization, Bedload, Erosion, Channels, Storm water, Hydrology, Water management(Applied), Stormwater basins, Downstream effects.

Urbanization decreases the natural storage of a watershed, which changes the timing characteristics of the runoff. Stormwater management (SWM) basins are an attempt to put the storage lost through development back into the runoff process. While SWM basins provide the proper volume of storage, they fail to return the timing characteristics to those that existed prior to development. The changes in storage and timing characteristics may have adverse effects on flow rates and bedload transport in downstream channel reaches. A study of a 2.12-sq mile watershed in Montgomery County, Maryland, showed that a SWM basin increased both peak flows and bedload transport rates in the channel downstream from the facility. This results from both the change in timing characteristics and the increased duration of bankfull flow. These results indicated that SWM policies must require evaluation os SWM plans on a regional basis and not just using on-site control criteria. Also, methods that can evaluate storage and timing changes must be used in the design of SWM facilities. (Sims-ISWS)
W80-02345

REGIONAL RUNOFF SIMULATION FOR SOUTHEAST MICHIGAN,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. A. Derecki, and A. J. Potok.
Water Resources Bulletin, Vol 15, No 5, p 1418-1429, October 1979. 6 Fig, 2 Tab, 3 Ref.

Descriptors: *Runoff, *Michigan, Basins, Watersheds(Basins), Soil moisture, Evapotranspiration, Rivers, Drainage, Model studies, Mathematical models, Precipitation(Atmospheric), Hydrology, Forecasting, *Lake Michigan Basin.

The feasibility of simulating monthly runoff for the southeastern portion of the Lake Michigan drainage basin, which comprises four major river basins, was evaluated with the Streamflow Synthesis and Reservoir Regulation watershed model. The evaluation covered a 13-year period (1961-73), which encompassed a complete runoff cycle. Results indicated that it is feasible to simulate monthly runoff volumes on a regional scale with a single equivalent watershed by using daily precipitation and temperature data. Simulation of regional flows appears particularly attractive for the Great Lakes basin, since the basin consists of many relatively small watersheds. This method also appears promising for development of monthly runoff forecasts by employing average monthly meteorological data distributed on a daily basis. Tests of six-month runoff forecasts showed relatively small deterioration with time and offered considerable improvement over climatology. (Sims-ISWS)
W80-02355

2F. Groundwater

A STATISTICAL APPROACH TO THE INVERSE PROBLEM OF AQUIFER HYDROLOGY, 1. THEORY,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
S. P. Neuman, and S. Yakowitz.
Water Resources Research, Vol 15, No 4, p 845-860, August 1979. 8 Fig, 2Tab, 48 Ref. OWRT B-051-ARIZ (2), 14-34-001-7135.

Descriptors: *Aquifer characteristics, *Statistical methods, *Regression analysis, *Transmissivity, *Heterogeneity, Aquifers, Numerical analysis, Water levels, Groundwater, Groundwater basins, Pump testing. Covariance, Pump test data.

A new, statistically based approach to the problem of estimating spatially varying aquifer transmissivities on the basis of steady state water level data was presented. The method involves solving a family of generalized nonlinear regression problems and then selecting one particular solution from this family by means of a comparative analysis of residuals. A linearized error analysis of the solution was included. This analysis allowed one to estimate the covariance of the transmissivity estimates as well as the square error of the estimates of hydraulic head. In addition to the explicitly statistical orientation of the method, it has an additional feature of permitting the user to incorporate a priori information about the transmissivities. This information may be based on actual field data such as pumping tests, or on statistical data accumulated from similar aquifers elsewhere in the world. A highly efficient explicit numerical scheme for solving the inverse problem in an approximate manner when errors in water level data are sufficiently small was also described. When these errors are large, the explicit scheme may still be useful for obtaining a rapid initial idea about the approximate location of the optimum solution. The theory was presented and was illustrated by a theoretical example. The purpose of this example was to demonstrate the effectiveness of the method in dealing with noisy data obtained from a known model. (Adams-ISWS)
W80-02050

BOUNDARY INTEGRAL EQUATION SOLUTION TO AXISYMMETRIC POTENTIAL FLOWS, 1. BASIC FORMULATION,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
G. P. Lennon, P. L-F. Liu, and J. A. Liggett.
Water Resources, Vol 15, No 5, p 1102-1106, October 1979. 5 Fig, 2 Tab, 10 Ref. NSF ENG 77-01479.

Descriptors: *Potential flow, *Boundaries(Surfaces), *Mathematical models, *Numerical analysis, *Free suraces, Equations, Groundwater movement, Unsteady flow, Steady flow, Mathematical studies, Boundary integral equation method, Axisymmetric flow.

In this paper the two-dimensional boundary integral equation method (BIEM) was extended to problems of axisymmetric flow governed by Laplace's equation. An 'axisymmetric' Green's function was defined, which led to a calculation procedure that parallels the two-dimensional theory. The result was a numerical method which is efficient and accurate for a variety of axisymmetric potential flow problems. (See also W80-02162) (Visocky-ISWS)
W80-02161

BOUNDARY INTEGRAL EQUATION SOLUTION TO AXISYMMETRIC POTENTIAL FLOWS, 2. RECHARGE AND WELL PROBLEMS IN POROUS MEDIA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
G. P. Lennon, P. L-F. Liu, and J. A. Liggett.
Water Resources Research, Vol 15, p 1107-1115, October 1979. 15 Fig, 1 Tab, 14 Ref. NSF ENG 77-01479.

Descriptors: *Potential flow, *Groundwater recharge, *Porous media, *Mathematical models, *Numerical analysis, Aquifers, Wells, Drawdown, Equations, Steady flow, Unsteady flow, Finite element analysis, Dupuit-Forchheimer theory, Boundary integral equation method, Axisymmetric flow.

The boundary integral equation method (BIEM) was employed to solve both steady and transient axisymmetric flow problems in porous media. The problems analyzed here are governed by Laplace's equation; however, the unsteady and nonlinear behavior result from the presence of a free surface. Both finite and infinite domains are easily handled with the BIEM. Results were presented for a variety of well and recharge problems. Comparisons of BIEM results to a linearized theory showed excellent agreement for recharge problems where the linearized theory is valid. In addition, results were obtained for cases where the linearized theory cannot be used. The BIEM solution for steady state well problems were in excellent agreement with solutions obtained by a finite element method, as well as the analytic solution using the Dupuit assumption. Finally, the BIEM yields solutions to a variety of transient well problems. It was concluded that the BIEM is both an accurate and efficient method for solving well and recharge problems. (See also W80-02161) (Visocky-ISWS)
W80-02162

ASSESSING PUBLIC GROUND-WATER SUPPLIES IN ILLINOIS,
Illinois State Water Survey, Urbana. Hydrology Section.
A. P. Visocky, and H. A. Wehrmann.
Ground Water, Vol 17, No 6, p 538-543, November-December 1979. 3 Fig, 2 Ref.

Descriptors: *Aquifers, *Groundwater, *Water supply, *Illinois, Water demand, Assessments, Wells, Water wells, Pumping, Groundwater resources, Water yield, Public utilities, Data processing, Data collections, Water supply adequacy, Public groundwater supplies.

Illinois aquifers furnish approximately 233 mgd (10.2 cu m/s) of water to 677 public water supplies outside the six-county area of northeastern Illinois. Groundwater is usually obtained from sand and gravel deposits in the glacial drift or from limestone or sandstone formations in the underlying bedrock. The most favorable groundwater conditions are found in the northern third and the southern tip of the State, while, elsewhere, major aquifers are sand and gravel deposits of the Mississippi, Illinois, buried Mahomet, Wabash, Ohio, Kaskaskia, and Embarrass valleys. A brief review was made of data and information in the State Water Survey files for each public groundwater supply, and an assessment was given as adequate, marginal, or deficient in terms of present demands. Twenty-four supplies were studied in greater detail, including calculations of aquifer sustained yields. The study indicated that 39 supplies were marginal and four were judged deficient in meeting current demands. The majority of the marginal and deficient supplies are located in the central third of the State; but so are most of the supplies (outside of northeastern Illinois). The study represented the

first of a three-part plan: (1) to define problem areas and determine priorities for studies in greater detail, (2) to conduct regional studies, including test drilling, in problem areas to determine how great the water resource is, and (3) to determine the water resource alternatives available to public groundwater supplies that are found to be inadequate. (Sims-ISWS)
W80-02170

GROUND-WATER POLLUTION BY TRANSFER OF OIL HYDROCARBONS,
Strasbourg Univ. (France). Inst. de Mecanique des Fluides.
For primary bibliographic entry see Field 5B.
W80-02173

USEFULNESS OF WELL REGISTRATION DATA,
Nebraska Univ., Lincoln. Dept. of Geology.
D. T. Pederson.
Ground Water, Vol 17, No 6, p 604-607, November-December 1979. 5 Fig, 4 Ref.

Descriptors: *Groundwater, *Transmissivity, *Water wells, *Data collections, *Nebraska, Drawdown, Pumping, Water yield, Maps, Mapping, Geology, Hydrogeology, Data processing, Analytical techniques, Well registration, Well registration data.

This investigation was to determine whether data on irrigation-well registration forms as reported by well drillers can be used in hydrologic studies. Transmissivity maps were prepared for Hamilton County, Nebraska, using only specific capacity values computed from yield and drawdown data, as reported on irrigation well-registration forms. On one map, each control point was the mean of the transmissivity values calculated for all wells in a section. On a second map, each control point was the mean of the means for fourt contiguous sections sharing a common corner. The second map was similar to that of a previously prepared map based on control point values computed from specific capacities of selected wells, test hole logs, and geologic interpretations. These results suggest that reported registration data for a given area have a normal population distribution. In situations where individual data are unverified, the data base can be treated as samples of a population where the mean of the means of several samples for adjacent areas is representative of actual field conditions. (Sims-ISWS)
W80-02174

OBSERVATIONS OF A POTENTIAL SIZE EFFECT IN EXPERIMENTAL DETERMINATION OF THE HYDRAULIC PROPERTIES OF FRACTURES,
California Univ., Berkeley. Lawrence Berkeley Lab.
P. A. Witherspoon, C. H. Amick, J. E. Gale, and K. Iwai.
Water Resources Research, Vol 15, No 5, p 1142-1146, October 1979. 6 Fig, 1 Tab, 9 Ref. USGS 14-08-0001-14583, NSF GK-42776, DOE W-7405-ENG-48.

Descriptors: *Fractures(Geologic), *Hydraulic properties, *Hydraulic conductivity, Laboratory tests, Rocks, Cores, Stress, Permeability, Fracture permeability, Groundwater, Groundwater movement, Radioactive wastes, Data processing, Analytical techniques, Hydrology, Size effects, Specimen size.

In several recent investigations, experimental studies on the effect of normal stress on the hydraulic conductivity of a single fracture were made by using three rock specimens ranging in cross-sectional area from 0.02 sq m to over 1 sq m. At the maximum stress levels that could be attained (10-20 MPa), minimum values of the fracture hydraulic conductivity were not the same for each rock specimen. These minimum values increased with specimen size, an indication that the determination of fracture conductivity may be significantly influenced by a size effect. The implications of these results are important. Cores collected in the field are normally not larger than 0.15 in diameter. However, the results of this work suggested that when a core of this size is used for laboratory investigations, the results may be nonconservative in that fracture permeabilities will be significantly lower than those that will be found in the field. If the results with an ultralarge core (0.95 m in diameter) are more indicative of field conductivities for a fracture under stress, then further work is needed to determine optimum specimen size so that reliable results on flow in fractures under stress will be available. (Sims-ISWS)
W80-02175

INDUCED GROUNDWATER RECHARGE IN THE GANGES BASIN,
Indian Inst. of Tech., New Delhi.
For primary bibliographic entry see Field 4B.
W80-02176

PROGRAMMABLE HAND CALCULATOR PROGRAMS FOR PUMPING AND INJECTION WELLS: I–CONSTANT OR VARIABLE PUMPING (INJECTION) RATE, SINGLE OR MULTIPLE FULLY PENETRATING WELLS,
Missouri Univ. Rolla. Dept. of Geological Engineering.
D. L. Warner, and M. G. Yow.
Ground Water, Vol 17, No 6, p 532-537, November-December 1979. 1 Tab, 7 Ref, 3 Append. EPA R-805039-01-0

Descriptors: *Water wells, *Injection wells, *Computer programs, Equations, Mathematical models, Hydraulic properties, Transmissivity, Storage, Porosity, Pressure, Pumping, Wells, Aquifers, Groundwater, Hand calculators.

Small programmable calculators have recently become available that will allow many routine pumping or injection well calculations to be made rapidly, accurately, and inexpensively. Programs and example calculations were given for the exponential integral and multiple well-multiple rate pumping or injection well equations using water well and oilfield units. The programs were for the TI 59 card programmable calculator. (Sims-ISWS)
W80-02183

UNSATURATED FLOW BENEATH TAILINGS IMPOUNDMENTS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
D. B. McWhorter, and J. D. Nelson.
Journal of the Geothechnical Engineering Division, American Society of Civil Engineers, Vol 105, No GT 11, Proceedings Paper 14999, p 1317-1334, November 1979. 7 Fig, 19 Ref, 1 Append.

Descriptors: *Impoundments, *Seepage, *Dams,* Unsaturated flow, *Mining, Mathematical models, Equations, Porous media, Hydraulic conductivity, Groundwater movement, Percolation, Phreatic lines, Linings, Clays, Darcys law, Embankments, *Tailings, Wetting front.

Using technology developed for flow through porous media for applications in other disciplines, equations were developed to permit computation of seepage rates from tailings impoundments. Seepage was shown to take place in three distinct stages. The first stage comprises a period during which a wetting front progresses downward from the impoundment. The second stage commences when the wetting front contacts either a phreatic surface or an impermeable boundary. The third stage begins when the groundwater mound contacts the bottom of the impoundment. During the third stage, flow occurs laterally away from the area beneath the impoundment. Example computations were presented for an impoundment with and without a liner. Particular conclusions regarding the variation of seepage rates depend on the boundary condtions of the situation being analyzed. Seepage rates increase almost linearly during the first two stages and decrease after the third stage has been reached. (Visocky-ISWS)
W80-02195

MODEL EVALUATION OF THE HYDROGEOLOGY OF THE CYPRESS CREEK WELL FIELD IN WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-02236

POTENTIOMETRIC MAP OF THE PALEOZOIC AQUIFER IN NORTHEASTERN MISSISSIPPI, OCTOBER AND NOVEMBER 1978,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Geological Survey Water-Resources Investigations 79-71 (open-file report), 1979. 1 Sheet, 5 Ref.

Descriptors: *Subsurface mapping, *Groundwater, *Water levels, *Potentiometric level, Water supply, Water wells, Observation wells, Aquifer characteristics, Groundwater resources, Mississippi, *Tishomingo County(Miss).

The Paleozoic rocks that outcrop in Tishomingo County, Mississippi, supply water to public, industrial, and domestic wells in two counties in the northeastern part of the State. Paleozoic rocks in the area consist mostly of beds of sandstone, shale, and limestone which dip about 30 feet per mile to the southwest. The potentiometric surface of the Paleozoic aquifer slopes generally to the west away from the area of outcrop and is strongly influenced by large ground-water withdrawals at Corinth. The water level at Corinth has declined about 140 feet since 1954. Pumping at Corinth has affected water levels in wells more than 10 miles from the center of pumping. (Woodard-USGS).
W80-02238

GEOLOGY AND GROUNDWATER RESOURCES OF WESTERN CRAWFORD COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
G. R. Schiner, and J. T. Gallaher.
Pennsylvania Geological Survey, Fourth Series, Water Resource Report 46, 1979. 103 p, 4 Fig, 3 Plates, 6 Tab, 31 Ref.

Descriptors: *Groundwater resources, *Hydrogeology, *Aquifer characteristics, *Water yield, *Water quality, Water wells, Well data, Water levels, Well casings, Geology, Stratigraphy, Groundwater availability, Groundwater recharge, Water analysis, Chemical analysis, Geologic mapping, Pennsylvania, *Western Crawford County(PA).

This report provides the necessary information on ground water (well water) to estimate with reasonable accuracy the casing requirements, potential yield, and quality of water yielded by wells drilled in western Crawford County, Pa. It should also help to understand why some wells are better than others nearby, even though they have the same depth. The report can be used as a guide by water managers, well drillers, and homeowners to help choose sites for maximum yield. The text contains a description of the aquifers (water-yielding rocks), data on depths and yields of wells, and information on the chemical quality of the ground water, and is accompanied by geologic maps and a well location map. (Woodard-USGS).
W80-02249

DETECTION METHODS FOR LOCATION OF SUBSURFACE WATER AND SEEPAGE,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
R. M. Koerner, J. S. Reif, and M. J. Burlingame.
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol 105, No GT 11, Proceedings Paper 14989, p 1301-1316, November 1979. 2 Fig, 2 Tab, 29 Ref, 1 Append. EPA R-80743.

Descriptors: *Dams, *Groundwater movement, *Seepage, *Measurement, *Non-destructive tests, On-site tests, Flow, Geophysics, Infrared radiation, Microwaves, Acoustics, Drainage, Tracers, Temperature, *Detection.

The problem of subsurface water and seepage location has classically utilized borings and interpolated information between them. Since high expenses can result and the intermittant information remain less than desirable, the search for a nondestructive test (NDT) method has attracted much attention. This paper presented a number of these NDT methods in outline form. Included was a review of detection methods based on flow measurement, tracers, temperature, infrared, microwave, geophysical, and acoustic emission sending schemes. A comparison of the methods and some generalized remarks concluded the paper. (Visocky-ISWS)
W80-02334

INFLUENCE OF WELL WATER QUALITY VARIABILITY ON SAMPLING DECISIONS AND MONITORING,
Science and Education Administration, Fresno, CA. Water Management Research.
For primary bibliographic entry see Field 5B.
W80-02356

THE IMPORTANCE OF SOIL IN EVALUATING POTENTIAL WASTE WATER DISPOSAL SITES IN THE MISSOURI OZARKS,
Missouri Univ., Columbia. School of Forestry, Wildlife and Fisheries.
For primary bibliographic entry see Field 2G.
W80-02357

2G. Water In Soils

USE OF INFILTATION EQUATION COEFFICIENTS AS AN AID IN DEFINING HYDROLOGIC IMPACTS OF RANGE MANAGEMENT SCHEMES,
Utah State Univ., Logan. Water Science Unit.
G. F. Gifford.
Journal of Range Management, Vol 31, No 2, p 115-117, March 1978. 4 Fig, 5 Ref. OWRT B-143-UTAH(2), 14-34-0001-7193.

Descriptors: *Infiltration, *Analytical techniques, Equations, *Soil physics, Soil water movement, Infiltrometers, Model studies, Mathematical models, Vegetation effects, Crop response, Pinyon-juniper, Utah, Range management.

The relationship between infiltration in rangeland plant communities and soil and vegetation characteristics has long been a subject of interest to hydrologists who have sought to express their results with specific models and equations. The purpose of the present study was to determine the relationship of selected rangeland vegetation characteristics and soil properties to the infiltration coefficients contained in three common infiltration equations; Horton's equation, Philip's equation and Kostiakor's equation. Data was collected using the Rocky Mountain infiltrometer on approximately 500 plots covering 13 pinyon-juniper (Pinus spp - Juniperus spp) plant communities scattered throughout Utah. Results indicated that Kostiakor's equation was related more to vegetation factors than to soil factors while Philip's equation was related more to soil factors than to vegetation factors. Horton's equation being intermediate between the two, represented vegetation and soil influences best. It is hoped that these results will be useful in determining long and short term temporal changes in infiltration rates as a function of specific management plans. (Tickes-Arizona)
W80-02146

SOIL HEAT TRANSDUCERS AND WATER VAPOR FLOW,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
J. W. Cary.
Soil Science Society of America Journal, Vol 43, No 5, p 835-839, September-October 1979. 5 Fig, 2 Tab, 9 Ref, 1 Append.

Descriptors: *Thermal conductivity, *Water vapor, *Soil water, *Laboratory tests, Heat transfer, Soils, Equipment, Laboratory equipment, Moisture content, diffusivity, Temperature, Soil temperature, Soil science, Water vapor flow.

The heat flow through a silt loam, silty clay, and loamy sand was measured in a calorimeter at 7 and 36C under matrix potentials near -0.3 bars. The transient thermal conductivity probe, the heat flux transducer, and deVries's theoretical method all gave low values of the apparent thermal conductivity at 36C. An empirical correction was proposed for deVries's method that improved its agreement with the observed conductivities. The thermal vapor diffusion coefficients for the three soils were then calculated from this equation and comared with experimental values from the calorimeter. It was also shown that the thermal water vapor flow can be estimated if one knows the soil's saturated thermal conductivity, quartz content, water content, bulk density, and temperature distribution. (Sim-ISWS)
W80-02163

FLUX-CONTROLLED SORPTIVITY MEASUREMENTS TO DETERMINE SOIL HYDRAULIC PROPERTY FUNCTIONS,
Science and Education Administration, Riverside, CA. Salinity Lab.
C. Dirksen.
Soil Science Society of America Journal, Vol 43, No 5, p 827-834, September-October 1979. 10 Fig, 55 Ref.

Descriptors: *Sorption, *Hydraulic conductivity, *Diffusivity, *Laboratory tests, Equations, Functions, Mathematical models, Infiltration, Gamma, Soil moisture meters, Equipment, Laboratory equipment, Soil water, Moisture content, Methodology, Soil science.

Using a new method, the hydraulic diffusivity and conductivity functions D(theta) and K(h) can be determined over most of their range in about 4 hours. This method uses a series of fast and simple, one-dimensional, absorption measurements for which the cumulative volumes of absorption are controlled proportional to the square root of time with syringes driven by cams. Each combination of motor speed, cam size, and syringe size represents an imposed sorptivity for which the water content and/or pressure head at the interface must be measured after they become steady. Steady values are normally reached after only a few minutes. Pressure heads can be recorded during the absorption runs, and at the end, a soil sample for gravimetric water content determination can be obtained in about 15 sec. Hydraulic diffusivity and conductivity functions derived from measured sorptivity functions were obtained for a variety of undisturbed and handpacked soil columns. They all showed excellent agreement with independent data. The flux-controlled boundary resulted in uniform wetting almost every time, whereas previously used potential-controlled boundary conditions often caused nonuniform wetting, which prevented accurate evaluation of sorptivities. The speed, range, and accuracy of this improved version of the sorptivity method compared favorably with other available methods. The method is suitable for routine and large-scale use. (Sims-ISWS)
W80-02164

TRANSPORT OF INORGANIC PHOSPHORUS IN AN ALFISOL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
O. A. de Camargo, J. W. Biggar, and D. R. Nielsen.
Soil Science Society of America Journal, Vol 43, No 5, p 884-890, September-October 1979. 5 Fig, 3 Tab, 26 Ref.

Descriptors: *Phosphorus, *Soils, *Soil water *Pore water, Movement, Flow, Soil water movement, Adsorption, Particle size, Pores, Laboratory tests, Numerical analysis, Mathematical models, Model studies, Phosphates, Nutrients, Soil science.

Absorption, desorption, and movement of phosphorus in an Alfisol soil were characterized by miscible-displacement and batch-type experiments. The influence of pore-water velocity, aggregate size, and pretreatment of the soil with P was evaluated. A model which considers the interaction of P with soil as an equilibrium kinetic process was utilized to differentiate between instantaneous and time-dependent reactions which appear to govern the adsorption-desorption process during displacement. Pore-water velocity has a greater influence on the adsorption rather than the desorption process which appeared to be more chemically controlled. Aggregate size affected the time-dependent more than the instantaneous processes of soil-P interaction. Instantaneous reactions between P and soil were shown to be mitigated by pretreatment of the soil with P in contrast to time-dependent reactions. A pore model was hypothesized to explain the differential uptake and release of P during displacement. (Sims-ISWS)
W80-02165

PARTICLE SIZE ANALYSIS BY HYDROMETER: A SIMPLIFIED METHOD FOR ROUTINE TEXTURAL ANALYSIS AND A SENSITIVITY TEST OF MEASUREMENT PARAMETERS,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resource Dept.
G. W. Gee, and J. W. Bauder.
Soil Science Society of America Journal, Vol 43, No 5, p 1004-1007, September-October 1979. 2 Fig, 3 Tab, 12 Ref. DOE JM-05-0103.

Descriptors: *Particle size, *Soils, *Sediments, *Hydrometers, Analytical techniques, Laboratory tests, Methodology, Sands, Clays, Sedimentation, Soil science, Clay determination, Mechanical analysis.

A simple modification of the Day hydrometer method was suggested for routine textural analysis. The simplified method requires no calibration, graphs, or tables and uses a weighted average of the 1.5-hour and 24-hour readings to determine the 2 micrometer clay fraction. The equation was found to be satisfactory in the range of summation percentage for the 2 micrometer clay fraction between 5% and 60% by weight for over 70 North Dakota soil and subsoil materials when the weighting factor was 0.876. Sensitivity analyses were performed for the Day, Bouyoucos, and the Simplified Day hydrometer methods to determine which of several measured parameters contribute to the greatest possible error; and hence, which parameters should be controlled with the greatest precision. The hydrometer scale reading error contributes more error than any other single parameter. (Sim-ISWS)
W80-02166

DISTRIBUTION AND PROPERTIES OF SOME TIDAL MARSH SOILS OF APALACHEE BAY, FLORIDA,
Florida Agricultural and Mechanical Univ., Tallahassee. Dept. of Earth and Plant Science.
C. L. Coultas, and E. R. Gross.
Soil Science Society of America Proceedings, Vol 39, No 5, p 914-919, September-October, 1975. 3 Fig, 4 Tab, 26 Ref.

Descriptors: *Soils, *Tidal marshes, *Florida, Wetlands, Marshes, Physical properties, Chemical properties, Conductivity, Sulfur, Hydrogen ion concentration, Cation exchange.

Three pedons representative of the major soils were described and sampled. The range of electrical conductivity is from 14 to 90 mmhos/cm. Field moist pH ranges from 5.6 to 7.8 and air dried pH values are 2 to 3 pH units lower. Content of S is less than 0.75 percent in the Psammaquents and Haplaquods to 6.8 percent in the Sulfaquents. Oxidation of S to sulfates was probably responsible for the increase of soil acidity after drying. Cation exchange capacity ranges from 2 to 25 meq/100 g for the Psammaquents and Haplaquods and from 25 to 75 meq/100 g for the Sulfaquents. Most soils are nearly base saturated. The soils classified in order of increasing elevation are members of the coarse-loamy, mixed, thermic Typic Sulfaquents; the sandy, siliceous, thermic Mollic Psammaquents; and the sandy, siliceous, thermic Aeric Haplaquods. Because of high potential acidity, low bearing strength, and high salinity, decisions concerning man's use of tidal marsh soils should be carefully made. Undisturbed, these are productive

soils performing functions valuable to man. (Stihler-Mass)
W80-02313

GROWTH OF PHRAGMITES COMMUNIS TRIN., TYPHA LATIFOLIA L., AND TYPHA ANGUSTIFOLIA L. IN RELATION TO THE FERTILITY OF SOILS,
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
For primary bibliographic entry see Field 2I.
W80-02330

A THERMAL CONDUCTIVITY PROBE DESIGNED FOR EASY INSTALLATION AND RECOVERY FROM SHALLOW DEPTHS,
Geological Survey, Lawrence, KS.
M. Sophocleous.
Soil Science Society of America Journal, Vol 43, No 5, p 1056-1058, September-October 1979. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Thermal conductivity, *Equipment, *Instrumentation, Electrical equipment, Sampling, On-site investigation, Soils, Soil water, Soil science, Thermal conductivity probes.

Existing designs of thermal conductivity probes were modified in order to build a probe suitable for easy installation and recovery from shallow depths above or below the water table in unconsolidated deposits. The performance of the thermal conductivity probe described here was compared to a recent probe design with satisfactory results; it was also successfully tested in the field. (Sims-ISWS)
W80-02348

COMPARISON OF VARIOUS METHODS OF SAMPLING SOIL WATER FOR DETERMINING IONIC SALTS, SODIUM, AND CALCIUM CONTENT IN SOIL COLUMNS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
K. A. Barbarick, B. R. Sabey, and A. Klute.
Soil Science Society of America Journal, Vol 43, No 5, p 1053-1055, September-October 1979. 1 Fig, 4 Tab, 12 Ref.

Descriptors: *Soils, *Soil water, *Salts, *Sewage effluents, Sampling, Laboratory tests, Ions, Sodium, Calcium, Leaching, Leachate, Sewage, Sludge disposal, Porous ceramic cups, Soil columns.

At the end of a column experiment studying the flux of ionic salts and Na(+) from applied sewage effluent, the salt, Na(+), and Ca(2+) contents were compared in extracts from porous cups, from the soils around the cups, and from saturated paste extracts after the column soils were air-dried. The salt level in the porous cup samples and in the moist soil samples obtained directly at the end of the experiment, and the Na(+) content in the porous cup and in saturated paste extracts that were equilibrated for 48 hours were highly correlated. (Sims-ISWS)
W80-02349

HYDRODYNAMIC DISPERSION DURING INFILTRATION OF WATER INTO SOIL,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
D. E. Elrick, K. B. Laryea, and P. H. Groenevelt.
Soil Science Society of America Journal, Vol 43, No 5, p 856-865, September-October 1979. 6 Fig, 4 Tab, 13 Ref, 1 Append.

Descriptors: *Hydrodynamics, *Dispersion, *Infiltration, *Soil water movement, Percolation, Mathematical models, Moisture content, Numerical analysis, Chlorides, Computer programs, Equations, Unsaturated flow, Unsteady flow, Miscible displacement, Computer simulation program.

The analysis of hydrodynamic dispersion during one-dimensional sorption of water by soil (horizontal flow) was extended to include the gravitational effects present during one-dimensional infiltration (vertical flow). A power series form for the solution was developed in a manner similar to that developed by Philip for water movement during infiltration. Similar to the sorption analysis, the longitudinal dispersion coefficient was assumed to be a function of water content only. A computer simulation program using CSMP was used to solve the associated differential equations. A single program was found to be suitable as long as the Boltzman parameter (distance divided by the square root of time) was used as the independent variable throughout. An algorithm was developed to give successively better solutions of the soil water diffusion and hydrodynamic dispersion equations. Infiltration experiments were carried out on a clay loam soil. Both the water and chloride content profiles preserved similarity in terms of the Boltzman parameter. Water and solute coefficients of the power series solutions were calculated from horizontal infiltration and hydraulic conductivity data and were used to predict both the water and solute profiles during vertical infiltration. Good agreement between the vertical infiltration data and the theoretical predictions was obtained. (Visocky-ISWS)
W80-02350

A NUMERICAL STUDY OF THE EFFECTS OF NONCAPILLARY-SIZED PORES UPON INFILTRATION,
Science and Education Administration, Coshocton, OH. North Appalachian Experimental Watershed.
W. M. Edwards, R. R. van der Ploeg, and W. Ehlers.
Soil Science Society of America Journal, Vol 43, No 5, p 851-856, September-October 1979. 7 Fig, 2 Tab, 41 Ref.

Descriptors: *Numerical analysis, *Soil water movement, *Unsaturated flow, *Infiltration, Pores, Runoff, Mathematical models, Hydraulic conductivity, Capillary action, Annelids, Worms, Channels, Tubes, Hydraulic properties, Surface-connected channels, Radial flux from holes, Large pore continuity.

A numerical solution to the unsaturated soil moisture flow equation was used to model infiltration into a soil containing surface-connected noncapillary holes. Input parameters used to demonstrate the model were those from an untilled silt loam soil whose infiltration characteristics are strongly influenced by worm holes, especially when rainfall rates are high. The two-dimensional model allows for vertical infiltration from the soil surface and for lateral infiltration from a vertical hole after excess precipitation on the surface runs into the hole. The model shows that the number of holes per unit soil area, as well as the diameter and depth of the holes, greatly influence infiltration and surface runoff. The assumption of noncapillary flow through continuous holes or cracks may be used to explain some of the observed deviations from capillary flow theory and the fast movement of surface-applied agricultural chemicals through the soil profile. (Visocky-ISWS)
W80-02351

THE USE OF A TRANSFORMED BOUNDARY CONDITION IN MODELLING AIR COMPRESSION DURING INFILTRATION,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
K. K. Watson, and A. A. Curtis.
Soil Science Society of America Journal, Vol 43, No 5, p 848-850, September-October 1979. 2 Fig, 9 Ref.

Descriptors: *Infiltration, *Air, *Soil water, *Numerical analysis, Model studies, Mathematical models, Boundary processes, Unsaturated flow, Hysteresis, Soils, Porous media, Pressure, Soil science.

A computer-based numerical analysis incorporating a time-dependent surface boundary condition transformation is of value in modelling the air compression effects which occur during ponded infiltration in bounded columns. However, the transformation requires clarification when used with materials which exhibit a well-defined water entry value. Since the capillary pressure head has no meaning in the saturated zone, which develops from the surface downwards during the infiltration process, it is necessary to define a pseudocapillary pressure head for this zone. This concept assists in developing a consistent qualitative argument showing that the one-phase, one-dimensional analysis accurately models the bounded flow regime. The condition which governs the termination of the analysis upon air escape was also considered. (Sims-ISWS)
W80-02352

WATER VAPOR MOVEMENT IN SOIL: RECONCILIATION OF THEORY AND EXPERIMENT,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
W. A. Jury, and J. Letey, Jr.
Soil Science Society of America Journal, Vol 43, No 5, p 823-827, September-October, 1979. 3 Fig, 2 Tab, 16 Ref.

Descriptors: *Water vapor, *Soils, *Heat transfer, Soil moisture, Temperature, Soil temperature, Heat, Movement, Soil properties, Model studies, Theoretical analysis, Mathematical models, Assessments, Laboratory tests, Measurement, Thermal conductivity, Soil science, Water vapor movement.

A large number of separate experimental studies of water vapor movement in response to thermal gradients were shown to be independent of water content over a wide range of water contents. Two models were rewritten in a compatible form and compared to the data. The phenomenological model of Cary describes the data if the phenomenological coefficient Beta has a value between 1 and 3.5, whereas the mechanistic theory of Philip and de Vries underpredicts the vapor transport observed in the experiments in all cases. A modification of the theory of Philip and de Vries was proposed which increases the influence of liquid water on vapor transport. In the new formulation, the experimental information was adequately described, and both models were rendered compatible. Both experimental and theoretical results suggested that water vapor movement may be described by a simple expression which is a known function of temperature, and is independent of water content over a wide range of saturation. Even without calibration it was suggested that this expression can describe water vapor flux to within a factor of 2. (Sims-ISWS)
W80-02353

THE IMPORTANCE OF SOIL IN EVALUATING POTENTIAL WASTE WATER DISPOSAL SITES IN THE MISSOURI OZARKS,
Missouri Univ., Columbia. School of Forestry, Wildlife and Fisheries.
C. D. Settergren, and L. C. Tennyson.
Water Resources Bulletin, Vol 15, No 5, p 1353-1364, October 1979. 5 Fig, 14 Ref.

Descriptors: *Sewage effluents, *Irrigation, *Nutrients, *Path of pollutants, *Missouri, Water pollution, Water pollution sources, Water chemistry, Soil water, Soil water movement, Neutron activation analysis, Nitrates, Calcium, Magnesium, Bromine, Tracers, Karst, Karst hydrology, Land application.

A number of criteria can be used in the selection of an area for the irrigation disposal of secondary treated wastewater. The inherent capacity of the surface soil to retain, or at least detain, the various nutrient ions passing through the profile in the percolating waters becomes the prime consideration in regions with shallow water tables or in karst areas such as the Missouri Ozarks where the risk of groundwater supply contamination is high. A comprehensive study of the nutrient renovation potential of several soils was undertaken at a proposed effluent irrigation site along the Ozark National Scenic Riverways in south central Missouri. The surface soil hydrology was evaluated employing selected soil water parameters. Exchange equilibria studies determined the retention capacity for Ca and Mg, while the concentrations of other selected ions were analyzed in the soil water to

measure their retention time and net removal. The movement of a bromine tracer was monitored as an index of the renovation capacity of these soils for the more mobile anions such as nitrate. Neutron activation analysis proved to be a useful tool in the water quality analyses. All surface soil profiles demonstrated some degree of nutrient renovation for the various nutrients studied. (Sims-ISWS)
W80-02357

2H. Lakes

DISTRIBUTION, GROWTH, AND PHOSPHORUS RELATIONSHIPS OF WATER MILFOIL IN LAKE WINNIPESAUKEE, NEW HAMPSHIRE,
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.
E. Chagnon, and A. L. Baker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124290, Price codes: A06 in paper copy, A01 in microfiche. Water Resource Research Center. University of New Hampshire. Research Report No 23, 1979. 107 p, 33 fig, 60 ref. OWRT A-043-NH(2), 14-31-0001-6030.

Descriptors: *Plant tissues, *Aquatic plants, *Phosphorus, *Lakes, Plant growth, Vegetation, Vascular tissues, *Lake Winnipesaukee, *New Hampshire, *Phosphorus uptake, *Myriophyllum heteropyllum, Water milfoil, Phosphorus concentration.

Myriophyllum heteirophyllum Michx. has been described as the dominant aquatic vascular plant in the littoral of Lake Winnipesaukee, N.H. its distribution, throughout the lake, was mapped and its habitat preferences were noted. The plant is present in areas with a silt-sand substrate and low wave action at depths of 0.5 to 3 m. The density of the stands was determined at three sites. Rapid colonization and stand expansion occurred through vegetative reproduction. Tissue phosphorus levels of M. heterophyllum varied seasonally during 1975-1976 and reached a maximum of 0.75% dry weight during late May. A correlation between tissue phosphorus and sediment phosphorus was observed for the three study sites. In situ phosphorus enrichment of the water produced a marked increase in tissue phosphorus of M. heterophyllum. Growth of the plants occurred from April through October with the maximum growth rate (June through August) at more than 1.5 cm/day. In batch culture tissue phosphorus levels of shoot apices are proportional to phosphorus levels in the medium. Luxury consumption of phosphorus was evident. Two uptake mechanisms appeared to function in phosphorus uptake. In culture both uptake and growth were affected by temperature, while growth rate was not affected by the phosphorus concentration in the medium. Phosphorus was released from decaying plants.
W80-02154

PHYSICAL AND CHEMICAL WATER QUALITY CHARACTERISTICS OF THE FOX CHAIN OF LAKES,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 5E.
W80-02167

SYNTHETIC HYDROLOGIC INFORMATION--A CASE STUDY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2E.
W80-02185

TEMPERATURE STRUCTURE IN LARGE BODIES OF WATER, ANALYTICAL INVESTIGATION OF TEMPERATURE STRUCTURE IN LARGE BODIES OF STRATIFIED WATER,
National Research Council of Ottawa (Ontario). Hydraulics Lab.
M. Rahman.
Journal of Hydraulic Research, Vol 17, No 3, p 207-215, 3 Fig, 2 Tab, 10 Ref.

Descriptors: *Thermal stratification, *Water temperature, *Mathematical studies, *Reservoirs, Analytical techniques, Theoretical analysis, Model studies, Lakes, Mathematical studies, Meteorological data, Heating, Spatial distribution, Heat transfer, Thermocline, Two layer model.

This article presented a two layer mathematical model for water temperature prediction in stratified reservoirs. The model included the nonlinear effects of the physical properties of water and the heat budget which accounts for vertical motion of the water body. A sensitivity analysis was performed with respect to the linear and nonlinear effects of the physical properties of water. Temperature profiles were determined by considering variable density, conductivity, and diffusivity, taking into account the influence of vertical motion of water but neglecting the effects of horizontal currents. Solution of the differential equation was effected by a similarity technique and applied to numerical problems. An analysis of profiles calculated under various assumptions indicated the importance of the major parameters. It also showed that neglecting the variation of physical properties with respect to temperature leads to significant differences in temperature profiles. (Humphreys-ISWS)
W80-02191

DISTRIBUTION, RESIDENCE TIME, AND FLUXES OF TETRACHLOROETHYLENE AND 1,4-DICHLOROBENZENE IN LAKE ZURICH, SWITZERLAND,
Eidgenossische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschut Zurich (Switzerland).
For primary bibliographic entry see Field 5B.
W80-02193

THE EFFECTS OF MOWING ON THE DYNAMICS OF QUANTITY, BIOMASS AND MINERAL CONTENTS OF REED (PHRAGMITES COMMUNIS TRIN.),
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
For primary bibliographic entry see Field 6G.
W80-02318

EFFECTS OF PEAT UTILIZATION ON WATER QUALITY IN MINNESOTA,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
For primary bibliographic entry see Field 6G.
W80-02327

THE INUNDATION ZONE OF THE NIGER AS AN ENVIRONMENT FOR PALAEARCTIC MIGRANTS,
Center for Overseas Pest Research, London (England).
For primary bibliographic entry see Field 2I.
W80-02328

2I. Water In Plants

DISTRIBUTION, GROWTH, AND PHOSPHORUS RELATIONSHIPS OF WATER MILFOIL IN LAKE WINNIPESAUKEE, NEW HAMPSHIRE,
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.
For primary bibliographic entry see Field 2H.
W80-02154

HALOPHYTES FROM COASTAL SALT MARSHES: A POTENTIAL SOURCE OF CROP PLANTS FOR ARID LANDS,
Delaware Univ., Newark. Coll. of Marine Studies.
G. F. Somers, M. Fontes, and D. M. Grant.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech Univ. Lubbock, p 402-417, July 1979. 4 Tab, 52 Ref.

Descriptors: *Halophytes, *Plant groupings, *Salt tolerance, *Crop response, *Plant breeding, *Soil-water-plant relationships, Saline soils, Saline water, Salt marshes, Saltbush, Saltgrass, Soil management(Applied), Environmental effects, Plant growth, Germination, Growth chambers, Varieties.

In the past the emphasis in salt-affected, arid region crop production has been on soil and water management with the view that there is little prospect of increasing the salt tolerance of conventional crops by breeding and selection. This paper, however, reports some efforts being made to select commercially useful plants which are highly salt tolerant, some of which might have potential as crops for arid lands. Seeds, collected mostly from tide marshes of estuaries along the eastern U.S. and the northern Gulf of California, were subjected to germination tests and grown in growth chambers, an illuminated room, or in the field and periodically flooded with saline water. More than 350 selections of over 60 species were evaluated by their vigor of growth in saline habitats, yield of fruit or other edible portion, general characteristics of edible portion, quality of fruit or edible portion, and potential for adapting to commercial production. The preliminary selection of a limited number of species that appear to merit further evaluation which resulted is discussed here according to family groups. (Tickes-Arizona)
W80-02198

THE EFFECTS OF WATER STRESS ON PHENOLOGY AND CARBOHYDRATE STORAGE IN THE SHORTGRASS PRAIRIE,
Science and Education Administration, Tucson, AZ.
J. R. Cox, and H. G. Fisser.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech Univ. Lubblock, p 529-537, July 1979. 2 Tab, 2 Fig, 18 Ref.

Descriptors: *Phenology, *Soil-water-plant relationships, *Plant morphology, *Environmental effects, *Moisture, Biochemistry, Nutrient requirements, Root systems, Seeds, Leaf water potential, *Carbohydrates, Soil texture, Plant groupings, Varieties, Roots, Stress, Wyoming.

This study was conducted in 1976 in Gillette, Wyoming, to determine the seasonal variation in leaf water potential (LWP), phenological development, and total nonstructural carbohydrates (TNC), and how various soil textural groups affected plant water use, morphology, and storage of nutrients in 2 important range forage species of the short-grass prairie region; western wheat grass (Agropyron smithii) and blue grama (Bouteloua gracilis). Individual plants of both species were selected bi-weekly during the growing season from 9 study areas; 3 of which were located on an area to be surface mined, 3 on sandy loams soils, and 3 on fine-textured loamy soils, on the basis of 4 criteria: phenological stage, basal diameter, height, and general appearance. Results indicated that LWP, phenological development, and TNC were similar on all soil types for both species of grass. Root reserves were found to be lowest on June 15 for western wheat grass with the elongation of leaves, whereas LWP was highest. Reserves were rapidly accumulated in early July, reaching maximum levels with the initiation of flowering. LWP increased during the following sampling period, whereas the level of reserves increased. Plants on loamy soils matured earlier during late July, while individuals on sandy soils matured more rapidly in late August, and reserves in blue grama gradually increased as LWP increased in all soils types. Seed formation, generally constant on soil types, matured slightly earlier on clayey soils. (Tickes-Arizona)
W80-02199

GUAR SHOWS POTENTIAL AS DROUGHT-TOLERANT SUMMER CROP FOR ARIZONA GRAIN FARMERS,
R. Dennis, and G. Webster.
Progressive Agriculture in Arizona, Vol 30, No 2,

p 10-11, Summer 1979.

Descriptors: *Crop response, *Drought tolerance, *Guar, *Seeds, *Irrigation practices, Agronomic crops, Legumes, Gum, Forages, Seasonal.

Summer-planted drought-tolerant guar (Cyanopsis psoralioides), a legume grown for forage and for its seeds which produce a gum used as a thickening agent and as a sizing material for paper and textiles, is gaining increased attention as a profitable annual crop to follow small grains harvested in May or June in the lower desert valleys of Arizona. Guar is also useful as an aflatoxin-free high protein feed. Irrigation management appears to be the key to success with this crop as grown on experimental plots in Arizona where an excess of 1500 pounds of seeds have been produced with as little as 18 inches of applied water. While most of the guar gum used in the U.S. is presently imported from India and Pakistan, Arizona researchers and extension agents see excellent potential for producing high quality guar locally in the near future. (Tickes-Arizona)
W80-02202

VEGETATIONAL RESPONSE TO THREE ENVIRONMENTAL GRADIENTS IN THE SALT PLAYA NEAR GOSHEN, UTAH COUNTY, UTAH,
Army Engineers District, New Orleans, LA.
M. G. Skougard, and J. D. Brotherson.
The Great Basin Naturalist, Vol 39, No 1, p 44-58, March 30, 1979. 4 Fig, 5 Tab, 4 Ref.

Descriptors: *Saline soils, *Salts, *Environmental effects, *Playas, *Plant groupings, *Soil moisture, *Environmental gradients, *Soil-water-plant relationships, Ecology, Varieties, Plant growth regulators, Frequency analysis, Soil physical properties, Correlation analysis, Niches, Biological communities, Utah, Hydrogen ion concentration.

Reported here are the results of a study to determine the response of both plant communities and individual species in and around a salt playa at the southern end of Utah Lake, south of Goshen Bay in Central Utah, to gradients of soluble salts, soil moisture and pH, the most crucial factors limiting plant growth in arid regions. Forty-eight 10 x 10 m study plots of homogenous vegetation were sampled within major vegetation zones and eight meter-square quadrants located at random within each plot were analysed through frequency and soil sample data to establish environmental gradients. Results indicated that vegetational types could be segregated by differential response to the three gradients studied. Correlation analysis indicated that 45% of the variation found in plant diversity could be accounted for by these 3 parameters with total soluble salts being the most influential. Niche width was found to exhibit no correlation to either of these gradients. (Tickes-Arizona)
W80-02205

THE EFFECTS OF A COAL FIRED POWER PLANT ON WETLANDS,
Indiana Univ. at Bloomington. School of Public and Environmental Affairs.
For primary bibliographic entry see Field 5C.
W80-02259

WETLAND REHABILITATION,
Environmental Concern, Inc., St. Michaels, MD.
For primary bibliographic entry see Field 4A.
W80-02287

AQUATIC VEGETATION AND WATER POLLUTION CONTROL PUBLIC HEALTH IMPLICATIONS,
Texas State Dept. of Health, Austin.
For primary bibliographic entry see Field 5D.
W80-02298

GRADIENT ANALYSIS OF THE VEGETATION IN A BRACKISH MARSH IN BELLINGHAM BAY, WASHINGTON,
Western Washington Univ., Bellingham. Dept. of Biology.
D. J. Disraeli, and R. W. Fonda.
Canadian Journal of Botany, Vol 57, No 5, p 465-475, March 1, 1979. 6 Fig, 5 Tab, 31 Ref.

Descriptors: *Saltwater marsh, *Vegetation, *Ecological distribution, Aquatic plants, Marshes, Wetlands, Biomass, Soils, Physical properties, Streams, Deltas, Gradation, Water levels.

The islands in the delta of the Nooksack River support a brackish marsh with maximum salinity of 5.18 parts per thousand (ppt). On high tides, the marsh is flooded with water from the river rather than from Bellingham Bay. Marsh species were distributed according to combinations of elevation, length of tidal submergence, sand and silt content of the soil, and soil moisture. Two broad marsh zones were recognized. The Scirpus americanus marsh occurs below 274 cm above mean lower low water (MLLW), where it is submerged on nearly all high tides. It has over 70 submergence days per year. Soils are sandy but poorly drained, and aerial biomass is low. The Carex lyngbyei marsh occupies sites above 274 cm. This zone has fewer than 50 submergence days per year. These sites have siltier soils, better soil-moisture values, and greater biomass. (Howard-Mass)
W80-02299

THE ENVIRONMENTAL FATE OF THREE DICHLOROPHENYL NITROPHENYL ETHER HERBICIDES IN A RICE PADDY MODEL ECOSYSTEM,
Illinois Univ. at Urbana-Champaign. Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W80-02301

PERSISTENCE AND FACTORS AFFECTING DISSIPATION OF MOLINATE UNDER FLOODED RICE CULTURE,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 5C.
W80-02302

SEASONAL DYNAMICS OF EPIPHYTIC ALGAL GROWTH IN A MARSH POND: COMPOSITION, METABOLISM, AND NUTRIENT AVAILABILITY,
Manitoba Univ., Winnipeg. Dept. of Botany.
N. M. Hooper-Reid, and G. G. C. Robinson.
Canadian Journal of Botany, Vol 56, No 19, p 2441-2448, October 1, 1978. 9 Fig, 20 Ref.

Descriptors: *Freshwater marshes, *Algae, *Growth, *Succession, *Nutrients, Nitrogen, Phosphorus, Silica, Chlorophyll, Standing crop, Rooted aquatic plants, Ponds, Chemical properties, Plant physiology, Canada.

Seasonal growth and succession of epiphytic algae on artificial substrates in a marsh pond were related to nutrient levels (N, P, and Si) and to various physiological indicators of nutrient availability, including chlorophyll content, protein to carbohydrate and lipid ratio, Si debt, storage phosphate levels, alkaline phosphatase activity, and nitrogenase activity. Low standing crops in June and early July coincided with indications of deficiency in terms of chlorophyll a content and protein to carbohydrate and lipid ratios at chosen Scirpus and Potamogeton sites. Low available N may have been limiting growth. In July and August, when available N, P, and Si were low, there was evidence of Si limitation of diatom growth at both sites. Growth of hererocystous, N2-fixing, blue algae and high alkaline phosphatase activity occurred in July at the Potamogeton site. Increased standing crop of epiphytic algae in September and October at the Scirpus site coincided with higher nutrient levels and an absence of deficiency symptoms. A delay in the standing crop increase at the Potamogeton site correlated with low nutrient levels and various physiological deficiency symptoms. (Howard-Mass)
W80-02303

AN IMPROVED, CONCEPTUALLY SIMPLE TECHNIQUE FOR ESTIMATING THE PRODUCTIVITY OF MARSH VASCULAR FLORA,
University of Southwestern Louisiana, Lafayette. Dept. of Biology.
C. T. Hackney, and O. P. Hackney.
Gulf Research Reports, Vol 6, No 2, p 125-129, December, 1978. 4 Fig, 14 Ref.

Descriptors: *Aquatic plants, *Productivity, *Statistical methods, Regression analysis, Wetlands, Marshes, Estimating equations, Ecology.

The estimation of the net primary productivity of marsh communities with a periodic maximum-minimum (PMM) technique has certain advantages over the long used maximum-minimum standing stock technique, but still retains the same conceptual simplicity. The final productivity estimate with PMM is based on the entire data set rather than just two points. Direct statistical comparisons between any two communities can be made. An estimate of the productivity by minor species in the community can also be made. The periodic model permits statistical comparisons about other variables in community growth such as the timing of the maximum standing crop. With certain assumptions, productivity estimates which account for the loss of live plant material during the growing season can be made without the tremendous amount of effort and time required by the Wiegert-Evans technique. Despite the increased utility the PMM technique requires no additional field effort. (Howard-Mass)
W80-02304

SEASONAL DYNAMICS OF EPIPHYTIC ALGAL GROWTH IN A MARSH POND: PRODUCTIVITY, STANDING CROP, AND COMMUNITY COMPOSITION,
Manitoba Univ., Winnipeg. Dept. of Botany.
N. M. Hooper-Reid, and G. G. C. Robinson.
Canadian Journal of Botany, Vol 56, No 19, p 2434-2440, October 1, 1978. 7 Fig, 3 Tab, 19 Ref.

Descriptors: *Freshwater marshes, *Algae, *Standing crop, *Productivity, Rooted aquatic plants, Wetlands, Marshes, Photosynthesis, Plant physiology, Ecology, Canada, Ponds.

The seasonal growth of epiphytic algae colonizing artificial cellulose acetate substrates positioned in a stand of Scirpus acutus Muhl. and in a zone of Potamogeton pectinatus L. in a marsh pond was quantified in terms of 14C photosynthetic uptake, cell volume, cell surface area, dry weight, and chlorophyll a, protein, carbohydrate, and lipid content. Standing crop and productivity increased at both sites in September and October, after generally low summer growth with the exception of the occurrence of heterocystous blue-green algae at the Potamogeton site in July. Factor analysis of interrelationships among the various parameters suggested that cell surface area was more directly related to productivity and various standing-crop parameters than was cell volume. (Howard-Mass)
W80-02305

ECOLOGIC AND PALEOECOLOGIC STUDIES IN THE FEIGNE D'ARTIMONT (VOSGES, FRANCE),
Utrecht Univ., (Netherlands). Lab. of Palaeobotany and Palynology.
C. R. Janssen, M. J. J. Cup-Uiterwijk, H. J. Edelman, J. Mekel-Te Riele, and J. P. Pals.
Vegetatio, Vol 30, No 3, p 165-178, August 20, 1975. 8 Fig, 3 Tab, 24 Ref.

Descriptors: *Bogs, *Palynology, *Vegetation, *Succession, *Geologic time, Wetlands, Swamps, Dating, France.

Pollen and macrofossil studies of cores in the raised bog part of a mire in the Vosges revealed an almost complete postglacial record. The major pollen assemblage zones, based upon features of the regional pollen types, have been described and their contacts dated by 14C dating. At 9000 BP a pine forest was replaced by mainly Corylus, and Quercus plus Ulmus migrated into the area. Tilia, Alnus and Acer arrived later. From 7500-5000 BP

forests of Corylus, Quercus, Tilia, Ulmus and Acer prevailed. Abies and Fagus are dominant in the vegetation from 5000 BP up to the present time. Carpinus immigrated around 3400 BP. In the present mire vegetation a number of vegetation types have been recognized and mapped. The local fossil assemblages have been compared with the species composition of present day plant communities. It is concluded that the raised bog part of the mire began its existence as a lake, that turned later into an intermediate fen (Caricion canescenti-fuscae). Ombrotrophic bog vegetation is present from 5000 BP on. (Howard-Mass)
W80-02306

PRODUCTIVITY AND COMPOSITION OF A BALDCYPRESS-WATER TUPELO SITE AND A BOTTOMLAND HARDWOOD SITE IN A LOUISIANA SWAMP,
Louisiana State Univ., Baton Rouge. Dept. of Marine Science.
W. H. Conner, and J. W. Day, Jr.
American Journal of Botany, Vol 63, No 10, p 1354-1364, November-December, 1976. 3 Fig, 5 Tab, 60 Ref.

Descriptors: *Primary productivity, *Forests, *Swamps, *Louisiana, Trees, Vegetation, Wetlands, Biomass, Ecology, Deciduous trees, Productivity.

The annual increase in stem biomass was 800 g dry wt/sq m for the bottomland hardwood site (BLH) and 500 g dry wt/sq m for the baldcypress-water tupelo site (CT). Litter-fall was 574 g dry wt/sq m for BLH and 620 g dry wt/sq m for CT. Harvest samples of herbaceous understory yielded 200 g dry wt/sq m and 20 g dry wt/sq m for BLH and CT, respectively. Minimum net primary production was calculated as the sum of the three; 1574 g dry wt/sq m/yr for BLH and 1140 g dry wt/sq m/yr for CT. Maximum estimates of herbaceous production and insect consumption were made by using values from the literature. Estimated total net primary productivity was 1733 g dry wt/sq m/yr for BLH and 1516 g dry wt/sq m/yr for CT. In bottomland hardwood areas, many woody species exist with Acer rubrum var. drummondii and Nyssa aquatica the most dominant. In the baldcypress-water tupelo, fewer woody species exist, and Taxodium distichum and N. aquatica dominated. (Stihler-Mass)
W80-02307

PEATLANDS,
Kings Coll., London (England). Dept. of Botany.
P. D. Moore, and D. J. Bellamy.
Elek Science, London, England. 1974. 221 p.

Descriptors: *Peats, *Wetlands, *Ecology, Aquatic life, Aquatic animals, Rooted aquatic plants, Chemical properties, Succession, Nutrients, Organic matter, Primary productivity, Microbiology, Ecosystems, Stratigraphy.

A summary of what is known concerning peatlands is presented in 10 chapters entitled: Geochemicals, Biogeochemicals and ecosystems; templates of peat formation; the geochemical template; mires--peat producing ecosystems; adaptation of mire organisms; peat stratigraphy--a record of succession; the microscopic components of peat; the world picture; the world's resource; and conservation. (Stihler-Mass)
W80-02310

THE EFFECT OF FLOODING ON LENGTH OF RESIDENCY IN THE WHITE-FOOTED MOUSE, PEROMYSCUS LEUCOPUS,
Illinois Univ. at Urbana-Champaign. Dept. of Zoology.
L. B. Blem, and C. R. Blem.
American Midland Naturalist, Vol 94, No 1, p 232-236, July, 1975. 3 Tab, 22 Ref.

Descriptors: *Mammals, *Rodents, *Flood plains, *Wildlife, Wetlands, Populations, Flooding, Vegetation.

White-footed mice, Peromyscus leucopus, remain on trapping grids longer on floodplains than on upland even though they are periodically subjected to flooding. Floodplain population levels ranged from 8.6 mice/ha (June) to 48.7 mice/ha (October). Upland populations fluctuated less and ranged from 2.2 mice/ha (April) to 23.2 mice/ha (October). The more dense herbaceous vegetation of the floodplain may provide food and protection from predation so that bottomland populations fare as well or better than their upland counterparts during years in which flooding is not severe. (Stihler-Mass)
W80-02311

DENSITY, BIOMASS, AND ENERGETICS OF THE BIRD AND SMALL MAMMAL POPULATIONS OF AN ILLINOIS DECIDUOUS FOREST,
Virginia Commonwealth Univ., Richmond. Dept. of Biology.
C. R. Blem, and L. B. Blem.
Transactions of the Illinois Academy of Science, Vol 68, No 2, p 156-164, 1975. 3 Tab, 20 Ref.

Descriptors: *Mammals, *Birds, *Flood plains, *Forests, Energy, Wildlife, Wetlands, Ecology, Biomass, Metabolism.

The population density, standing crop biomass, consuming biomass, diversity and standard metabolism of avian and mammalian communities were quantified over an annual cycle from studies of flood plain and upland forest plots in Hart Woods, Champaign County, Illinois. The flood plain bird and mammal populations each consistently had greater population density, standing crop biomass, consuming biomass and standard metabolism than their counterparts on the upland. Avian diversity was highest on the flood plain. Total annual minimal energy budgets are: floodplain mammals, 3,846 Mcal; flood plain birds, 3,371 Mcal; upland mammals, 2,684 Mcal; and upland birds, 2,214 Mcal. (Stihler-Mass)
W80-02312

MICHIGAN COASTAL WETLANDS: WHAT GOOD ARE THEY.
Booklet I, MICH U--SG--79--502, March, 1979. 6 p, 1 Fig. Michigan Sea Grant Communications, Ann Arbor, MI.

Descriptors: *Wetlands, *Coastal wetlands, *Michigan, Floods, Water quality, Wildlife, Fish, Agriculture, Recreation, Urbanization, Environmental impacts.

Michigan's coastal wetlands perform important ecological functions as natural water purification and flood control systems and provide habitats for fish and wildlife. Population pressures and increasing urbanization are forcing reassessment of land values, and there are pressures to use remaining wetlands for agricultural or recreational uses or for further urban development. (Stihler-Mass)
W80-02315

AN OVERVIEW OF ST. JOHN'S MARSH, ST. CLAIR COUNTY, MICHIGAN.
For primary bibliographic entry see Field 6G.
W80-02316

THE EFFECTS OF MOWING ON THE DYNAMICS OF QUANTITY, BIOMASS AND MINERAL CONTENTS OF REED (PHRAGMITES COMMUNIS TRIN.),
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
For primary bibliographic entry see Field 6G.
W80-02318

DEVELOPMENT OF PHRAGMITES COMMUNIS TRIN. DEPENDING ON THE AMOUNT OF AVAILABLE SOIL,
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
W. Szczepanska.
Polskie Archiwum Hydrobiologii, Vol 24, No 3, p 311-318, 1977. 3 Fig, 5 Tab, 6 Ref.

Descriptors: *Marsh plants, *Plant growth, *Planting management, Wetlands, Vegetation establishment, Marsh management, Crop production, Density, Competition.

Experiments were conducted to determine the amount of soil indispensable for the unconstricted growth and development of Phragmites communis. It was found that the greater the amount of soil available the greater the weight of one shoot, the height and the number of the shoots produced, and the greater the biomass per square meter. Differentiation in height and the number of shoots occurred after about 70 days of culturing. The development of Phragmites under the conditions of competitive pressure is carried through by means of plastic adaptation to the biotope resources of the environment and by partial elimination of other individuals. Under the conditions of smaller amounts of soil, Phragmites plants exploit the available ground more thoroughly. (Steiner-Mass)
W80-02319

DEVELOPMENT OF THE UNDERGROUND PARTS OF PHRAGMITES COMMUNIS TRIN. AND TYPHA LATIFOLIA L.,
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
W. Szczepanska.
Polskie Archiwum Hydrobiologii, Vol 23, No 2, p 227-232, 1976. 2 Fig, 2 Tab, 4 Ref.

Descriptors: *Marsh plants, *Cattails, *Growth stages, Wetlands, Biomass, Standing crop, Root development, Plant growth.

In the first weeks of Phragmites communis and Typha latifolia growth, the root/shoot ratio was 0.56 and 0.95, respectively. After 10 weeks of development, the ratio was 1.22 and 1.14. On September 1, the time of the maximum biomass of the aboveground parts of P. communis, the ratio was 1.85 and 1.13. On September 15, the time of the maximum biomass of the aboveground parts of T. latifolia, the ratio was 2.00 and 1.11. On October 1, a decrease in the biomass of the aboveground parts of P. communis was observed and at the same time the weight of the whole plant increased, indicating a further increase in the weight of the underground parts of the plant. A decrease in weight of the aboveground parts of T. latifolia was observed on October 15, and at that time the root/shoot ratio was 3.0 and 1.2. (Steiner-Mass)
W80-02320

WETLAND CLASSIFICATION IN WESTERN CANADA: A GUIDE TO MARSHES AND SHALLOW OPEN WATER WETLANDS IN THE GRASSLANDS AND PARKLANDS OF THE PRAIRIE PROVINCES,
Canadian Wildlife Service, Saskatoon(Saskatchewan).
For primary bibliographic entry see Field 6B.
W80-02321

MARYLAND USES NALED AGAINST SALT MARSH MOSQUITOES.
Pest Control, Vol 46, No 5, p 14, 16 and 18, May, 1978. 3 Fig.

Descriptors: *Mosquitoes, Insecticides, *Salt marsh, Wetlands, Pest control, Pesticides, Maryland, Insect control.

An experimental, 640-acre application of naled was performed on a Chesapeake Bay salt marsh to test its effects on mosquitoes and on selected non-target species. There was better than an 80 percent kill on mosquitoes and the mortality rate of non-target species was the same in both test and control areas. (Steiner-Mass)
W80-02322

ON THE RELATIVE DOMINANCE OF SHRUBS IN OKEFENOKEE SWAMP,
California Univ., Santa Barbara. Dept. of Biological Sciences.
W. H. Schlesinger.
American Naturalist, Vol 112, No 987, p 949-954,

September-October, 1978. 1 Fig, 2 Tab, 19 Ref.

Descriptors: *Shrubs,*Swamps, *Georgia, Wetlands, Vegetation, Aquatic plants, Productivity, Biomass, Burning, Ecology, Trees, Importance values.

Twenty-five random 2 x 2 m quadrants were sampled in each of 17 cypress forest stands. The shrub species in Okefenokee are those characteristic of southern acid bog environments. Most of the shrub layer biomass and productivity is comprised of the four shrub species which had the highest importance values (Itea virginica, Lyonia lucida, Leucothoe racemosa, Clethra alnifolia) and saplings of cypress and Nyssa sylvatica var. biflora. Total biomass in the shrub layer was 527 g/sq m; true shrub species accounted for 330 g/sq m. Density of shrub stems ranged from 14,900 to 42,800 stems/ha. The importance values for the shrubs in Okefenokee Swamp appear to be distributed according to MacArthur's broken-stick model. (Stihler-Mass)
W80-02323

HALOPHYTES: ADAPTIVE MECHANISMS,
W. H. Queen.
In: Physiological Ecology of Estuarine Organisms, F. J. Vernberg, editor, University of South Carolina Press, Columbia, S. C., p 205-211, 1975. 17 Ref.

Descriptors: *Aquatic plants, *Estuaries, *Salts, *Physiological ecology, Wetlands, Salinity, Plant morphology, Rooted aquatic plants, Salt balance, Ecology.

Major obstacles related to the presence of a high salt concentration which must be overcome if plant growth is to occur in an estuarine environment are: (1) acquisition of water from an external source with a high osmotic pressure; (2) maintenance of internal ionic balance; and (3) absorption of sufficient essential nutrients from a medium with an ionic mix unfavorable to higher plants. Halophytes have a variety of mechanisms for regulating their internal ionic balance and concentration including salt glands, shedding of salt-packed leaves, translocation of salt to roots and excretion into soil, and dilution by the development of succulent leaves. Mechanisms regulating salt absorption may prove to be more important than 'salt removal' techniques in controlling the internal ionic balance. Enzyme adaption may be an important factor in halophyte tolerance of high cellular salt concentrations. (Stihler-Mass)
W80-02324

DEVELOPMENT OF SOME LAKE ECOSYSTEMS IN TROPICAL AFRICA, WITH SPECIAL REFERENCE TO THE INVERTEBRATES,
Newcastle-upon-Tyne Univ. (England). Dept. of Zoology.
A. J. McLachlan.
Biological Review, Vol 49, p 365-397, 1974. 7 Fig, 2 Tab, 134 Ref.

Descriptors: *Lakes, *Succession, *Ecology, *Invertebrates, Wetlands, Rooted aquatic plants, Trees, Aquatic animals, Fish, Mud, Sediments, Chemical properties, Physical properties.

The giant man-made lakes, Kariba and Volta, provide the bulk of the data used for this review. The flooding of a lake basin initiates a series of changes leading eventually to a more stable climax situation after some years. The course of development appears to fall into two periods based on water level changes, the filling stage and the post-filling stage. The former is characterized by sudden appearances of organisms and explosive growths of animal and plant populations. Massive developments of large floating plants occur. During the post-filling phase the substrata are modified by the development of mud habitats under the influence of processes like sedimentation and beach formation, the development of submerged woodlands as habitats for bottom dwelling animals, the spread of rooted aquatic plants and fluctuations in water levels. Rooted plants may provide breeding nurseries for economically important fish species. (Stihler-Mass)
W80-02325

EFFECTS OF PEAT UTILIZATION ON WATER QUALITY IN MINNESOTA,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
For primary bibliographic entry see Field 6G.
W80-02327

THE INUNDATION ZONE OF THE NIGER AS AN ENVIRONMENT FOR PALAEARCTIC MIGRANTS,
Center for Overseas Pest Research, London (England).
P. J. Curry, and J. A. Sayer.
Ibis, Vol 121, p 20-40, 1979. 7 Fig, 27 Ref, 1 Append.

Descriptors: *Niger River, *Flood plains, *Migratory birds, *Temporal distribution, Wetlands, Rivers, Africa, Waterbirds, Distribution patterns, Census, Waterfowl, Grasslands, Wildlife habitats.

Of at least 350 species recorded within the inundation zone, 108 (31%) are wholly or partially of Palaearctic origin. Five main habitats are recognized in the region: wetland, hygrophilous grassland, transition zone, non-flooded areas, and aerial. The habitats, the Palaearctic migrants and their possible competitors are described and discussed. The annual Niger flood regime enables Palaearctic waterbirds to find suitable habitats somewhere within the region during all seasons, but most widely during the autumn and winter months of the flood recession. Non-aquatic species inhabiting flood plain grasslands are scarce during the Palaearctic autumn becoming commoner and more diverse during the winter months. Wetland warblers of the genera Acrocephalus and Locustella have not been recorded on autumn passage. It is suggested that in some years at least, these and other trans-Saharan migrants from the West Palaearctic overfly the Sahelian latitudes of mid-west Africa. Species inhabiting the transition zone are most in evidence at the end of the winter period and during the spring hot, dry season, prior to northward trans-Saharan migration. Habitats and species encountered in the non-flooded areas are similar to those recorded in the Sahel zone elsewhere in West Africa. (Steiner-Mass)
W80-02328

GROWTH OF PHRAGMITES COMMUNIS TRIN., TYPHA LATIFOLIA L., AND TYPHA ANGUSTIFOLIA L. IN RELATION TO THE FERTILITY OF SOILS,
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
W. Szczepanska, and A. Szczepanski.
Polskie Archiwum Hydrobiologii, Vol 23, No 2, p 233-248, 1976. 6 Fig, 9 Tab, 20 Ref.

Descriptors: *Marsh plants, *Cattails, *Plant growth, *Soil-water-plant relationships, Wetlands, Biomass, Standing-crop, Fertility, Soils.

The dependence of the production of Phragmites communis and both species of Typha on the content of mud in the soil was distinctly evident under experimental conditions. The increment of the biomass of Phragmites concomitant with the increment of the mud content in the soil is the resultant of an increase in weight of the individual stem and the sprouting of a greater number of new shoots. The increment of the biomass of T. latifolia and T. angustifolia is due chiefly to the increase in weight of the individual plant. The dependence of the production of the plants on the fertility of the soil is strongest in T. latifolia and weakest in Phragmites. An increase of the eutrophic mud content in the soil by 10 percent causes an increment of the plants biomass as follows: in Phragmites--0.28 g dry weight; T. angustifolia--0.35 g; and T. latifolia--0.56 g. (Steiner-Mass)
W80-02330

COMBINED ACTION OF POLYPHENOILS, QUINONES, REDUCERS AND CERTAIN OTHER COMPOUNDS ON AQUATIC PLANTS,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
For primary bibliographic entry see Field 5F.
W80-02331

2J. Erosion and Sedimentation

THE EFFECT OF TILLAGE SYSTEMS ON PESTICIDES IN RUNOFF FROM SMALL WATERSHEDS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. L. Baker, and H. P. Johnson.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 3, p 554-559, May-June 1979, 2 Fig, 4 Tab, 19 Ref. OWRT B-050-IA(3), 14-31-0001-5037.

Descriptors: *Pesticides, *Runoff, *Erosion, Farm practices, Sampling, On-site investigations, Rainfall, Watersheds(Basins), Agricultural watersheds, Insecticides, Herbicides, Sediments, Chemical analysis, Path of pollutants, Tillage practices.

Runoff losses of fonofos (insecticide), alachlor, atrazine, and cyanazine (herbicides) with sediment and water were measured under natural rainfall conditions for 6 small watersheds planted to continuous corn with conventional, till-plant, and ridge-plant tillage systems. Losses were very dependent on the time between pesticide application and the first runoff event. Soil sampling indicated that pesticide half-lives were about 2 weeks (except for atrazine, 1 to 2 months), with pesticides remaining concentrated in the top 5 cm. Not quite 50% of the average fonofos loss was with water, whereas from 80 to 90% of the average herbicide losses were with water. Decreased runoff and erosion for the till-plant and ridge-plant tillage systems relative to conventional resulted in decreased pesticide losses, but pesticide concentrations in sediment and (or) water were sometimes higher for conservation tillage systems. (Sims-ISWS)
W80-02147

PARTICLE SIZE ANALYSIS BY HYDROMETER: A SIMPLIFIED METHOD FOR ROUTINE TEXTURAL ANALYSIS AND A SENSITIVITY TEST OF MEASUREMENT PARAMETERS,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resource Dept.
For primary bibliographic entry see Field 2G.
W80-02166

MISSISSIPPI RIVER SHOALING: A DIAGNOSTIC STUDY,
Iowa Univ., Iowa City, Inst. of Hydraulic Research.
For primary bibliographic entry see Field 2E.
W80-02186

FLOW FIELD AND SCOURING EFFECTS OF STEADY AND PULSATING JETS IMPINGING ON A MOVABLE BED,
Stuttgart Univ. (Germany, F.R.). Inst. fuer Wasserbau.
H. Kobus, P. Leister, and B. Westrich.
Journal of Hydraulic Research, Vol 17, No 3, p 175-192, 1979. 12 Fig, 17 Ref.

Descriptors: *Scour, *Model studies, *Erosion, *Jets, Stream erosion, Movement, Erosion rates, Hydraulic models, Laboratory tests, Dimensional analysis, Flow, Steady flow, Analysis, Data collections, Analytical techniques, Shape, Unsteady flow, Flow characteristics, *Impinging jets, Movable beds, Scour holes.

The mean and fluctuating components of the flow field of vertical submerged jets impinging on a horizontal rough wall were measured, and the time-development of scour holes due to submerged jets impinging on sand beds of uniform grain size was studied experimentally. Particular attention was paid to the quantification of pulsation effects upon the flow field and the scouring process. The results allowed quantitative assessment of the various parameters upon the scouring process for steady and pulsating jets. In particular, the follow-

ing general conclusions can be derived from the study (1) The scouring process has a logarithmic time dependence. The erosion capacity of a jet depends upon its momentum flux, the nozzle distance from the bed, and the properties of the bed material. (2) Depending on the magnitude of a pressure parameter, different scour forms may e generated. For small values of K sub o (1.2 to 3) one obtains form I, for large values of K sub o (6.5 to 140) the form II, whereas very values of K sub o lead to injection flow. (3) Scour form I shows a shallow profile, in which the wall jet is attached up to the edge of the scour hole. Erosion takes place mainly in the form of bedload transport. (4) Scour form II exhibits a strong deformation in the inner region, where erosion takes place, and straight flanks in the outer region of the scour hole, in which transport in suspension and partial deposition take place. (5) Periodic pulsation of the jet can cause a significant increase of the erosion capacity. This is due to the following factors: (a) more favorable erosion and transport conditions in the deflected jet due to a diminished pressure gradient along the bed; (b) smaller energy loss into the seepage flow on account of the reduction of the pressure gradient, which reduces the seepage flow; and (c) better efficiency of the turbulent transport because of the pronounced radial correlation of the radial velocity components around the circumference. (Humphreys-ISWS)
W80-02188

HYDROLOGIC DATA ON CHANNEL ADJUSTMENTS 1970 TO 1975, ON THE RIO GRANDE DOWNSTREAM FROM COCHITI DAM, NEW MEXICO, BEFORE AND AFTER CLOSURE,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. D. Dewey, R. E. Roybal, and D. E. Funderburg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-301134, Price codes: A23 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-70, May 1979. 531 p, 83 Fig, 3 Tab, 12 Ref.

Descriptors: *Sediment transport, *Channel morphology, *Pre-impoundment, *Post-impoundment, *Distribution patterns, Sediment distribution, Sediment yield, Particle size, Hydrologic data, New Mexico, *Rio Grande(N MEX), Cochiti Dam(N MEX).

Cross-section channel profiles, sediment transport and hydrologic data have been observed and computed for a series of pre-dam and post-dam investigations from 1970 to 1975 at 37 cross sections established along a 59-mile study reach from Cochiti Dam to Isleta Diversion Dam, New Mexico. Cochiti Dam began impounding water in November 1973. Because the dam will trap virtually all of the sediment load originating upstream and water discharge will be controlled, it is expected that equilibrium values of channel width, depth, slope and sediment-transport capability in the existing main stem of the Rio Grande will change. Changes in cross sections with time and space and changes in size distribution of sediments are documented. (Woodard-USGS).
W80-02230

INCEPTION OF SEDIMENT TRANSPORT,
Queen's Univ., Kingston (Ontario), Dept. of Civil Engineering.
M. S. Yalin, and E. Karahan.
Journal of the Hydraulics Division, Anerican Soceity of Civil Engineers, Vol 105, No HY11, Proceedings Paper 14975, p 1433-1443, November 1979. 5 Fig, 1 Tab, 19 Ref, 2 Append.

Descriptors: *Bed load, *Sediment transport, *Alluvial channels, *Boundary processes, Movement, Sedimentation, Laminar flow, Turbulent flow, Laboratory tests, Analytical techniques, Analysis, Boundary layers, Shear stress, Sands, Cohensionless soils, Flow, Shields curve, Critical shear stress.

Sediment transport inception curves corresponding to both laminar and turbulent flows were presented. Using these curves, one can determine the critical bed shear stress (corresponding to the beginning of sediment transport), depending on the properties of the fluid and of the cohesionless bed material. The laminar flow curve has been revealed on the basis of laboratory measurements. The curve corresponding to turbulent flows was established mainly using the available datd of previous researchers. It was found that the laminar flow curve lies in the Shields' plane higher than the turbulent flow curve, and thus it yields larger critical values of the dimensionless bed shear stress. Both curves tend to become indistinguishable from each other when the grain size Reynolds number decreases. i.e., when the influence of viscosity on the turbulent flow at bed increases. For larger values of this number, the turbulent flow curve can be identified with the classical Shields' curve. (Humphreys-ISWS)
W80-02340

CHEMICAL AND SUSPENDED-SEDIMENT CHARACTERISTICS OF RIVERS OF INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
For primary bibliographic entry see Field 2A.
W80-02400

2K. Chemical Processes

COMPOSITION OF TRINIDAD RAINFALL,
University of the West Indies, St. Augustine (Trinidad).
R. C. Dalal.
Water Resources Research, Vol 15, No 5, p 1217-1223, October 1979. 3 Fig, 8 Tab, 46 Ref.

Descriptors: *Chemistry of precipitation, *Rainfall, *Rain water, *Chemical analysis, *Statistical analysis, Chemicals, Nutrients, Nitrogen compounds, Magnesium, Calcium, Sodium, Potassium, Chlorine, Sulfur compounds, Sulfur, Sampling, Soils, *Trinidad.

The rainwater collected from daily rainfalls at 6 rainfall stations in Trinidad over a 1-year period was analyzed for NH4(+), NO3(-), urea-N, Mg(2+), Ca(2+), Na(+), K(+), Cl(-), and SO4(2-) concentrations. The concentration of these constituents varied from 0.41 to 1.13, 0.41 to 1.24, 0.15 to 0.50, 0.33 to 0.99, 1.88 to 4.52, 1.92 to 2.57, 1.21 to 3.27, 2.10 to 3.93, and 1.89 to 17.75 mg/l of NH4-N, NO3-N, urea-N, Mg(2+), Ca(2+), Na(+), K(+), Cl(-), and SO4(2-), respectively. Considerable amounts of these constituents were added to the soil through rainfall. Major proportions of NH4(+) and NO3(-) and some proportions of SO4(2-) in rainwater may have been derived from gaseous sources, probably originating from soil. Urea-N seems to have originated as particulate matter from soil organic matter and microbial cell debris. Greater proportions of Ca(2+) and K(+), and smaller proportions of Mg(2+) and SO4(2-) appear to have been derived from terrestrial dust. Sodium, Cl(-), Mg(2+) and partly Ca(2+), K(+), and SO4(2-) were derived from marine sources. Thus, it appears that the sources of various constituents in the Trinidad rainfall are quite varied. (Sims-ISWS)
W80-02179

QUALITY OF SURFACE AND GROUND WATERS, YAKIMA INDIAN RESERVATION, WASHINGTON, 1973-74,
Geological Survey, Tacoma, WA. Water Resources Div.
M. O. Fretwell.
Geological Survey open-file report 77-128, 1979. 177 p, 29 Fig, 2 Plates, 6 Tab, 38 Ref.

Descriptors: *Water quality, *Surface waters, *Groundwater, *Indian reservations, *Washington, Water analysis, Chemical analysis, Irrigation water, Fertilizers, Nitrates, Phosphates, Pesticides, Trace elements, Dissolved solids, Bacteria, Physical properties, *Yakima Indian Reservation(Wash).

This report describes the quality of the surface and ground waters of the Yakima Indian Reservation in south-central Washington, during the period November 1973-October 1974. The average dissolved-solids concentrations ranged from 48 to 116 mg/L (milligrams per liter) in the mountain streams, and from 88 to 372 mg/L in the lowland streams, drains, and a canal. All the mountain streams contain soft water (classified as 0-60 mg/L hardness as CaC03), and the lowland streams, drains, and canal contain soft to very hard water (more than 180 mg/L hardness as CaC03). The water is generally of suitable quality for irrigation, and neither salinity nor sodium hazards are a problem in waters from any of the streams studied. The specific conductance of water from the major aquifers ranged from 20 to 1,540 micromhos. Ground water was most dilute in mineral content in the Klickitat River basin and most concentrated in part of the Satus Creek basin. The ground water in the Satus Creek basin with the most concentrated mineral content also contained the highest percentage composition of sulfate, chloride, and nitrate. For drinking water, the nitrate-nitrogen concentrations exceeded the U.S. Public Health Service's recommended limit of 10 mg/L over an area of several square miles, with a maximum observed concentration of 170 mg/L. (Woodard-USGS).
W80-02245

EFFECTS OF PEAT UTILIZATION ON WATER QUALITY IN MINNESOTA,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
For primary bibliographic entry see Field 6G.
W80-02327

2L. Estuaries

THE ALASKAN OUTER CONTINENTAL SHELF ENVIRONMENTAL ASSESSMENT PROGRAM,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
For primary bibliographic entry see Field 5C.
W80-02064

PREDICTING LEVEL OF DISSOLVED REACTIVE PHOSPHATE IN THE LAFAYETTE RIVER, VIRGINIA, FROM INFORMATION ON TIDE, WIND, TEMPERATURE, AND SEWAGE DISCHARGE,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
For primary bibliographic entry see Field 5B.
W80-02178

SHORT-TERM COVARIABILITY OF CHLOROPHYLL AND TEMPERATURE IN THE ST. LAWRENCE ESTUARY,
Laval Univ., Quebec. Dept. de Biologie.
S. Demers, P. R. Lafleur, L. Legendre, and C. L. Trump.
Journal of the Fisheries Research Board of Canada, Vol 36, No 5, p 568-573, May 1978. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Estuaries, *Water quality, *On-site investigations, *Tidal effects, Water temperature, Chlorophyll, analysis, Analytical techniques, On-site data collections, Phytoplankton, Tidal waters, *St. Lawrence estuary.

Time series of chlorophyll a fluorescence and temperature taken at a depth of 1 m were recorded at 4-min intervals for 136.5 h, at an anchor station located in the Middle Estuary of the St. Lawrence. The sampling program was carried out during the transition from neap tides to spring tides. Power spectral analysis was applied to the series, and variance spectral estimated. Coherency spectra between fluorescence and temperature were also computed. Results indicated that chlorophyll distribution was controlled by physical processes during neap tides. Conversely, lesser amounts of chlorophyll a per cell and lesser production rates were noted during spring tides. A flattening of the chlorophyll spectrum was observed for this part of the study. This result was interpreted in terms of the poor physiological state of the phytoplankton population that was sampled during the second part of the study, a different density structure

being present due to the change in tidal energy. (Humphreys-ISWS)
W80-02184

SEA SURFACE TEMPERATURES NEAR A BAY INLET ZONE,
Brookhaven National Lab., Upton, NY. Atmospheric Sciences Div.
M. D. Powell, and S. Sethuraman.
Journal of Geophysical Research, Vol 84, No C11, p 7012-7016, November 20, 1979. 7 Fig, 1 Tab, 11 Ref. DOE EY-76-C-02-0016.

Descriptors: *Water temperature, *Bays, *Inlets(Waterways), *Coasts, *New York, Remote sensing, Aircraft, Surveys, Temperature, Winds, Flow, Tides, Tidal waters, Weather, Estuaries, Sea surface temperatures.

Results of an investigation of the radiometric sea surface temperature distribution near Shinnecock Inlet off Long Island were presented. The data were gathered by 10 individual aircraft flights during the summer of 1975. Inflow into or outflow from the inlet could be easily identified with sea surface temperature measurements. (Sims-ISWS).
W80-02220

MITIGATION: A CONCEPT FOR WETLAND RESTORATION,
Oregon State Dept. of Land Conservation and Development, Salem.
For primary bibliographic entry see Field 6E.
W80-02288

MARYLAND USES NALED AGAINST SALT MARSH MOSQUITOES.
For primary bibliographic entry see Field 2I.
W80-02322

HALOPHYTES: ADAPTIVE MECHANISMS,
For primary bibliographic entry see Field 2I.
W80-02324

HALOPHYTES, ENERGETICS AND ECOSYSTEMS,
Georgia Univ., Athens. Inst. of Ecology.
E. P. Odum.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.), Academic Press, Inc., New York, p 599-602, 1974. 3 Ref.

Descriptors: *Salt marshes, *Energy budget, *Ecosystems, Wetlands, Marshes, Marsh plants, Energy transfer, Productivity, Succession, Georgia.

Halophyte communities such as salt marshes in tidal estuaries have a productivity in the range of 10,000 to 40,000 kcal/sq m/year, and are clearly subsidized by the energy of the tides, waves, and other water flows. The high productivity of such stands is in sharp contrast to halophyte communities growing in or around a salt lake where the same level of sun energy might be received, but where there is no mechanical energy subsidy to overcome the stress of the salty substrate. The salt marsh estuary functions as a detritus ecosystem as does a young forest or a freshwater marsh, but unlike a stable water level marsh, or an early successional terrestrial community, litter does not accumulate in the estuary because tidal action hastens removal and decomposition of net production as fast as it is produced. Accordingly, the Spartina salt marsh in Georgia is viewed not as a successional stage leading to another type of vegetation but as a pulse-stabilized climax where change over long periods of time is more a function of geologic or allogenic, such as a changing sea level, than autogenic processes within the ecosystem. (Steiner-Mass)
W80-02329

WAVE DIFFRACTION BY ABSORBING WEDGE,
Math-Tech Inst., Charlottenlund (Denmark).
J. Larsen.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 105, No WW4, Proceedings Paper 15000, p 439-449, November 1979. 4 Fig, 14 Ref, 4 Append.

Descriptors: *Waves(Water), *Breakwaters, *Model studies, Mathematical models, Refraction(Water waves), Absorption, Winds, Hydraulics, Coasts, Harbors, Diffraction, Wave diffraction, Impedance, Absorbing wedges.

Diffraction of waves by a vertical absorbing wedge was examined. A useful approximate solution, which is in contrast to previous results and is applicable when the two wedge faces have different reflection properties, was presented. The approximate solution was compared with the asymptotic representation of the exact solution to the impedance wedge diffraction problem revealing good agreement. The approximate solution has been used in a harbor theory for wind-generated waves. (Sims-ISWS)
W80-02335

INLET STABILITY SOLUTIONS FOR TRIBUTARY INFLOW,
Army Engineer District, Mobile, AL.
F. F. Escoffier, and T. L. Walton, Jr.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 105, No WW4, Proceedings Paper 14964, p 341-355, November 1979. 7 Fig, 2 Tab, 8 Ref, 4 Append.

Descriptors: *Inlets(Waterways), *Currents(Water), *Estuaries, *Florida, Bays, Oceans, Tributaries, Coasts, Tides, Tidal waters, Circulation, Stability, Water circulation, Velocity, Water levels, Model studies, Mathematical models, Coastal engineering.

Formulas in use relating to the flow of water through tidal inlets do not take into account the joint effects of inertia and tributary inflow that play a significant role in determining the characteristics of many inlets. In a proposed analytical model, these two factors are considered where the tributary inflow to the bay causes ebb flow through the inlet to exceed flood flow. The solution method applies to the same type inlets previously studies, i.e., inlets that have a bay in which the water rises and falls uniformly over the entire bay area. An additional assumption is that the discharge into and from the inlet is governed by a head loss that is quadratic in velocity. (Sims-ISWS)
W80-02339

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE POTENTIAL OF ECONOMIC DESALINIZATION FOR SMALL SYSTEMS,
URS Corp., San Mateo, CA.
For primary bibliographic entry see Field 6B.
W80-02001

DEVICE FOR PRODUCING DEEPLY DESALTED WATER,
N. N. Azarov, G. A. Zelensky, and I. V. Borisovsky.
U.S. Patent No 4,165,273, 5 p, 2 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 686, August 21, 1979.

Descriptors: *Parents, *Desalination, *Water purification, *Separation techniques, Membranes, Electrodes, Ion exchange, Resins, Desalination apparatus.

A device is proposed for producing deeply desalted water. The device comprises a dielectric housing in which cooled electrodes and ion-exchange membranes are located. The electrodes are rods located parallel with respect to one another in vertexes of at least one regular hexagon with alternating polarity. Each membrane is made in the form of a tube and located concentrically to the corresponding electrode, the polarity of the membrane and of the electrode being the same. The device comprises desalinization chambers for sorption of the salt ions from the water being treated, the chambers being filled with ion-exchange resins. The desalination chambers are formed by membranes, located between them and connected with each other. The device also contains brine chambers for removing the salt ions with the water being passed through the chambers. Each brine chamber is defined by one of the corresponding membranes. The proposed device is small in size, highly efficient, reliable and safe in operation. (Sinha-OEIS)
W80-02066

DESALINATION METHOD WITH MERCURY REFRIGERANT,
Fabrication de Maquinas, S. A. Monterrey (Mexico).
J. K. Martin.
U.S. Patent No 4,164,854, 4 p, 2 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 551-552, August 21, 1979.

Descriptors: *Patents, *Desalination, *Water purification, *Separation techniques, Saline water, Freezing, Crystal growth, Heat exchange, Mercury, Desalination apparatus.

A salt water purification apparatus and process utilizes a vertically arranged elongated tank in which salt water is first frozen into a solid block and then melted to provide pure water. The freezing is accomplished by injecting into a column of salt water within the tank, a finely atomized spray of precooled mercury to absorb heat from the water and to initiate the formation of ice crystals in the ice column. The mercury is continuously recirculated through a cooling means and the ice crystals accumulate in the upper portion of the tank due to their inherent buoyancy when they form a solid block of ice. A heat exchanger positioned in the upper portion of the tank thaws the upper portion of the ice block by indirect heat exchange with the incoming salt water feed. The block is moved upwardly in the tank due to hydraulic pressure created below the block by the salt water feed. Fresh water can therefore, be continuously or intermittently withdrawn from the upper portion of the tank and concentrated brine and precipitated salts withdrawn from the lower portion of the tank. (Sinha-OEIS)
W80-02080

FUNDAMENTAL STUDIES OF DESALINATION BY FREEZING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
K. A. Smith, and A. F. Sarofim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124316, Price codes: A04 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, January 1979. 72 p, 34 Fig, 8 Tab, 10 Ref. OWRT (No 3268)(1), 14-20-3268.

Descriptors: *Desalination, *Freezing, *Crystal growth, Crystallization, *Nucleation, Supercooling, *Heat transfer, *Mass transfer, Diffusion, Permeability.

Studies on a pilot-scale crystallizer were used to determine the subcooling of the brine solution, the particle size distribution and the permeability of the ice product in a 6% by weight brine solution for various ice preduction rates, agitation powers, and ice concentration. These data were used to generate ice crystal growth rates and nucleation rates to compare with generalized correlations developed for ice growth and nucleation. By application of population balance mathematics to a well-stirred continuous crystallizer, a quantitative relationship between ice partice size and ice production rate was developed. The growth kinetic parameters needed for application of the resulting relations were determined from a systematic study of the mass transfer to discs, spheres, and cylinders suspended in a turbulent agitated fluid. The results could be represented by a single correlation be-

tween the Sherwood number, the Schmidt number, and the Kolmogoroff power number, for a range of impeller designs and types, vessel aspect ratios, and impeller-to-vessel dimensions. Correlations for ice nucleation kinetics were determined from batch crystallizer studies for a wide range of salt concentration, solution subcooling, and agitation power. (Sarofim-Mit)
W80-02155

DEVELOPMENT OF A COMPOSITE REVERSE OSMOSIS MEMBRANE FOR SINGLE PASS SEAWATER DESALINATION,
Envirogenics Systems Co., El Monte, CA.
A. F. Graefe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124 852, Price codes: A03 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, No 1223-15, February 1979. 35 p, 3 Ref. OWRT (No 7541)(1), 14-34-0001-7541.

Descriptors: *Reverse osmosis, *Membrane, *Composite, *Seawater, *Desalination, *Furfuryl alcohol, *Sulfonated furfuryl alcohol, *Sulfonated phenol-aldehyde, *Sulfonated polyphenylene oxide, Polysulfone, Spiral element, Non-cellulosic.

The objective was to develop an improved reverse-osmosis composite non-cellulosic membrane for the single pass desalination of seawater, and to demonstrate its performance in the form of four inch diameter spiral elements. Three membranes were investigated. One membrane consisted of an active barrier layer of polymerized and sulfonated furfuryl alcohol deposited on the surface of a cloth-backed polysulfone microporous support (SPFA membrane). This membrane exhibited outstanding initial reverse-osmosis properties (water fluxes up to 23 gfd at 99.6% salt rejection with simulated seawater at 800 psi), but was inherently unstable. The seat of the instability is believed to lie in the hydrolytic cleavage, with attendant depolymerization, of sulfate ester groups present in the barrier layer. Another membrane consisted of a sulfonated, phenol-aldehyde resin on the same polysulfone support (SPAR). This membrane was also inherently unstable for the reason noted above. The third membrane, which consisted of a sulfonated polyphenylene oxide on the same polysulfone support (SPPO), was found to be unsuitable for the single pass desalination of seawater. It was concluded from the overall experimental data that the fabrication of composite membranes at elevated temperatures in the presence of sulfuric acid is probably attended by complex side reactions, one or more of which could easily lead to membrane instability.
W80-02295

DEVELOPMENT OF LOW PRESSURE BRACKISH WATER REVERSE OSMOSIS MEMBRANES,
Envirogenics Systems Co., El Monte, CA.
A. F. Graefe, and W. J. Schell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-126204, Price codes: A03 in paper copy, A03 in microfiche. Final Report to Office of Water Research and Technology No 1093-25, May 1979. 37 p, 3 Fig, 5 Ref. OWRT (No 7510)(1), 14-34-0001-7510.

Descriptors: *Reverse osmosis, *Membrane, *Composite, *Brackish water, *Desalination, *Furfuryl alcohol, *Sulfonated furfuryl alcohol, *Sulfonated polysulfone, Polysulfone, Spiral element, Non-cellulosic, Yuma feedwater.

The objective was to develop chemically stable non-cellulosic desalination membranes with reverse osmosis properties at pressures of 250 psi or less that are equivalent to those of currently available cellulosic membranes operating at 400 psi. It was also desired that the new membranes exhibit improved chemical stability over cellulosic membranes. Several membranes were investigated. One membrane consisted of a thin layer of sulfonated polyfurfuryl alcohol on a microporous polysulfone as a support (SPFA). This membrane exhibited water flux values up to 50 gfd at 98% salt rejection when tested at 250 psi with 0.5% sodium chloride. However, subsequent long term testing of the membrane in element form at 100 to 300 psi showed that it was unstable to simulated Yuma feedwater. Another membrane of interest was asymmetric, and was fabricated from a sulfonated polysulfone (SPS). It was resistant to biodegradation, to high and low pH levels, to elevated temperatures, and to at least 50 ppm of free chlorine. This membrane exhibited excellent stability after an initial deswelling period when tested with simulated Yuma feedwater at 100 to 300 psi, but its reverse osmosis properties were not superior to those of cellulose acetate. Other membranes investigated either exhibited low water flux values or low salt rejection values when tested under brackish water conditions.
W80-02296

3B. Water Yield Improvement

RUNOFF FARMING FOR JOJOBA,
Science and Eduction Administration, Phoenix, AZ. Water Conservation Lab.
D. H. Fink, and W. L. Ehrler.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech Univ., Lubbock, p 212-224, July 1979, 3 Fig, 1 Tab, 23 Ref.

Descriptors: *Water requirements, *Jojoba, *Growth rates, *Water harvesting, *Water yield improvement, Water conservation, Rainfall-runoff relationships, Microenvironment, Catchments, Runoff farming, Experimental farms.

The water requirement of Jojoba (Simmondsia chinensis), a potentially important wax-producing agronomic crop in arid regions, is determined and evaluated here in terms of the prospects of utilizing runoff farming to supply the needed water. Thirty of the most stressed female plants within a one ha fenced marginal stand of Jojoba in the Usery Mountains of the Tonto National Forest near Mesa, Arizona, were selected and randomly divided into 3 runoff-farming treatments of ten plants each. Undisturbed controls, cleared, smoothed, and rolled individual 20m2 microcatchments that directed runoff to a 4m2 runon areas were constructed for each plant. Results indicated that while the minimum water requirement for plant survival in the Phoenix area was 200mm of precipitation, Jojoba seemed to have sigmoidal response to available water, exhibiting essentially no increased growth from this minimum to threshold of 400-500 mm and then accelerated growth beyong this amount. Runoff farming successfully supplied the estimated 900-1300mm a month water requirement for Jojoba based upon a 4 m2 growing area. It is concluded that while more related research is needed, runoff farming should be easily adaptable to Jojoba plantation conditions. (Tickes-Arizona)
W80-02196

WATER YIELD INCREASES THROUGH SURFACE DUSTING OF A PERMANENT ICEFIELD,
White River National Forest, Glenwood Springs, CO.
For primary bibliographic entry see Field 2C.
W80-02358

3C. Use Of Water Of Impaired Quality

MUNICIPAL RECYCLING OF WASTEWATER,
Denver Research Inst., CO.
For primary bibliographic entry see Field 5D.
W80-02044

WASTEWATER APPLICATIONS TO IRON-ORE OVERBURDEN MATERIAL IN NORTHEASTERN MINNESOTA: PROSPECTS FOR RENOVATION AND RECLAMATION,
Minnesota Univ., St. Paul. Dept. of Forest Resources.
For primary bibliographic entry see Field 5E.
W80-02052

THE EFFECT OF SEWAGE SPRAY IRRIGATION ON DISEASE VECTORS - JULY 1975 - DECEMBER 1978,
Michigan State Univ., East Lansing, Dept. of Entomology.
M. Zaim, H. D. Newson, J. S. Rogers, and E. L. Payne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-123656, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report, December, 1979. 20 p, 3 Fig, 1 Tab, 23 Ref. OWRT B-040-MICH(1), 14-31-0001-6040.

Descriptors: *Sewage, *Wastewater spray irrigation, *Mosquitoes, Vectors, Dog heartworm, California encephalitis, St. Louis encephalitis, *Water quality project site, *Michigan, Spray irrigation planning and operations.

Four consecutive years of municipal sewage disposal by spray irrigation produced marked changes in the populations and species composition of the mosquitoes present in an experimental water quality management project in Michigan (Michigan State University). These changes are described and their relevance to the wide-spread use of similar sewage disposal systems are discussed. The impact of these changes on the transmission potential of enzootic mosquito-borne diseases in the vicinity of the project site also is discussed. The study results support the contention that planners and managers of similar sewage spray irrigation projects should be aware of the biological consequences of their operations and incorporate appropriate safeguards to minimize or prevent the potential for insect pests and disease transmission problems that are inherent in the operation of these types of sewage disposal systems. (Newson-Michigan)
W80-02156

SALT-TOLERANT CROPS AND SALINE WATER: RESOURCES FOR ARID LANDS,
California Univ., Davis. Dept. of Land Air and Water Resources.
D. B. Kelly, J. D. Norlyn, and E. Epstein.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech Univ. Lubbock, p 326-334, July 1979. 24 Ref.

Descriptors: *Salt tolerance, *Plant physiology, *Sea water, *Saline water, *Plant breeding, *Crop response, Feasibility studies, Variability, Soil-water-plant relationships, Photosynthesis, Transpiration, Adsorption, Arid lands.

Reported are the results of a feasibility study conducted on the selection and breeding of salt-tolerant crops for agriculture under extreme conditions of salinity: irrigation with seawater in the coastal sands of Northern California. Evidence is presented that there exists within certain crop species the genetic variability that when properly identified and expressed can allow strains of that crop to tolerate highly saline media. Data from three years of fields trials using seawater irrigation shows that crops specifically selected for salt tolerance provide appreciable yields under this very saline condition. Perhaps the most important by-product of the present study was the generation of plants with contrasting salt tolerance. The physiology of each line so far investigated can be compared with its sensitivie or tolerant counterpart. Ion uptake and transport, photosynthetic and transpirational responses, and the many structural differences found in sensitive and salt-tolerant lines are currently being investigated and promise to be invaluable in the search for explanations of how plants tolerate salinity stress. (Tickes-Arizona)
W80-02197

EFFECT OF USING SEWAGE EFFLUENT ON CALCAREOUS SOILS,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.

B. D. McCaslin, and V. Lee-Rodriquez.
In: Arid Land Plant Resources, Proceedings of the International Arid Land Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech Univ. Lubbock, p 598-614, July 1979, 4 Fig, 5 Tab, 32 Ref.

Descriptors: *Water reuse, *Calcareous soils, *Water pollution effects, *Soil-water-plant relationships, *Rates of application, *Cycling nutrients, Sewage treatment, Sewage sludge, Water pollution sources, Effluents, Heavy metals, Crop response, Environmental effects, Irrigation water, New Mexico.

Although the beneficial effects of treated municipal wastewater or sludges in arid regions are well known, it is important to restrict application rates to levels that will prevent both the build up of toxic materials in the environment and the pollution of groundwater supplies. The objectives of the present study were to examine the effects of long term applications of secondary sewage effluent on (1) the iron and heavy metal concentrations in a calcareous soil, and (2) on plants grown in this soil. Fields that had been irrigated for 40 years with secondary sewage effluent from the city of Clovis, New Mexico, were compared by physical and chemical analysis to adjacent fields which had never irrigated with effluent. Plant tissue analysis indicated normal concentrations of the micronutrients Fe, Zn, Mn, and Cu and no detectable Cd, Ni, Cr, and Pb after 40 years of effluent application on calcareous soils. Effluent data indicated no salt or sodium hazard and no Cd, Cr, Ni, or Pb accumulation. In general it was concluded that sewage effluent is a potential source of irrigation water and plant nutrients on southwestern agricultural calcareous soils. (Tickes-Arizona)
W80-02200

FUTURE SOURCES OF COOLING WATER FOR POWER PLANTS IN ARID REGIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 3E.
W80-02354

3D. Conservation In Domestic and Municipal Use

DEVELOPING A CONSERVATION PROGRAM TAILORED TO AREA NEEDS,
Mathematical Sciences Northwest, Bellevue, WA.
G. R. Minton, R. William, and T. Murdock.
American Water Works Association Journal, Vol 71, No 9, p 486-496, September 1979. 3 Fig, 4 Tab, 12 Ref.

Descriptors: *Water conservation, *Water demand, *Municipal water, *Water consumption, *Consumptive use, *Water supply, Water utilization, Anchorage(AK), Wastewater reuse, Metering, Building codes, Water management(applied), Water policy.

This article examines alternative water use measurement and water conservation options for the city of Anchorage (AK), one of the fastest growing urban areas of the United States. Population is expected to double by 2000, and present groundwater sources are inadequate. Water conservation could mitigate the area's water supply problem for the next decade by providing time to develop new sources. The U.S. Army Corps of Engineers and the municipality of Anchorage have jointly studied the water resources for the area. Three large purveyors serve the area in addition to 13 small purveyors and individual wells. Water use in the area increases in winter as consumers run water continuously to prevent their pipes from freezing; water for the purpose averaged 12.5 ML/day (3.3 mgd) from the Anchorage Water Utility (AWU), the largest purveyor. Estimated 1977 water use (29.1 mgd) exceeded 1976 production (28.7 mgd). Water conservation methods that can be used to achieve residential conservation include increased water metering, public education, pricing systems, devices and appliances, and establishment of stricter building codes; industrial and commercial conservation can be achieved through rate structures for sewer services and water costs. Additional conservation can be achieved through better management and maintenance of the existing city sewer system. It is recommended that freeze-prone pipes be buried deeper. Three possible conservation program options--low intensity, moderate and high intensity--are suggested and costs and savings for each presented. Savings would range from $219,000 and 5.4 mgd to $5.71 million and 16.8 mgd by the year 2000. (Arnold-NC)
W80-02045

URBAN DROUGHT IN THE SAN FRANCISCO BAY AREA: A STUDY OF INSTITUTIONAL AND SOCIAL RESILIENCY,
Teknekron, Inc., Berkeley, CA.
For primary bibliographic entry see Field 6D.
W80-02046

LEAK DETECTION: MODERN METHODS, COST, AND BENEFITS,
East Bay Municipal Utility District, Oakland, CA.
For primary bibliographic entry see Field 6B.
W80-02136

A DO-IT-YOURSELF LEAK SURVEY BENEFIT-COST STUDY,
Los Angeles City Dept. of Water and Power, CA.
For primary bibliographic entry see Field 6B.
W80-02137

3E. Conservation In Industry

URBAN DROUGHT IN THE SAN FRANCISCO BAY AREA: A STUDY OF INSTITUTIONAL AND SOCIAL RESILIENCY,
Teknekron, Inc., Berkeley, CA.
For primary bibliographic entry see Field 6D.
W80-02046

FUTURE SOURCES OF COOLING WATER FOR POWER PLANTS IN ARID REGIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
W. A. Jury, G. Sinai, and L. H. Stolzy.
Water Resources Bulletin, Vol 15, No 5, p 1444-1458, October 1979. 3 Fig, 5 Tab, 31 Ref.

Descriptors: *Cooling water, *Arid lands, *Powerplants, Water requirements, Water resources, Water demand, Legislation, Evaporation, Water users, Consumptive use, Environment, Environmental effects, Industry, Industrial wastes, Water quality, Irrigation, Blowdown water, Evaporation ponds.

Electric generation facility water requirement will increase substantially in the future in the Western United States because new power plants are to be constructed at inland sites rather than on the coast. At the inland locations, power plants will have to compete with agriculture and public users for freshwater supplies, and will be constrained by environmental legislation to dispose of cooling waste water in lined evaporation ponds. The various options for power plant cooling were analyzed in respect to cost, water consumption, and environmental hazard, and also in respect to their compatibility with existing state and federal regulations. Several proposals for balancing the water requirements of various users in water-scarce areas were reviewed and criticized. (Sims-ISWS)
W80-02354

3F. Conservation In Agriculture

SPRINKLER HEAD WITH IMPROVED INTEGRAL IMPACT ARM AND ANTI-BACKSPLASH DRIVE SPOON,
Nelson (L. R.) Corp., Peoria, IL. (Assignee).
K. J. Bruninga.
U.S. Patent No 4,164,324, 10 p, 8 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 985, No 2, p 369, August 14, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, *Sprinkler irrigation, Irrigation efficiency, Irrigation practices.

A part-circle step-by-step rotary sprinkler head has an improved anti-backsplash drive spoon integrally formed as a part of the impact arm. Its construction is related to the longitudinal axis of the outlet when the arm is in its impact limiting position which comprises upper and lower walls in a position to receive the stream between them. (Sinha - OEIS)
W80-02139

BRACING ATTACHMENT FOR WHEELED SPRINKLER SYSTEM,
M. Ellison.
U.S. Patent No 4,164,323, 4 p, 3 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 985, No 2, p 368-369, August 14, 1979.

Descriptors: *Patents, *Irrigation systems, *Application equipment, Irrigation efficiency, Irrigation practices, Irrigation operation and maintenance.

The invention relates to bracing devices for selectively immobilizing certain of the wheels in a wheeled sprinkler system used to irrigate agricultural crops. Attached to the selected wheels are braces comprising two pivoted arms which can be swung between a first, inoperative position within the compass of the wheel and a second, operative position in which the two arms located 180 degrees apart extend outwardly and downwardly at approximately 45 degrees from the wheel into engagement with the ground. A foot plate carrying spikes on the ends of the arms enhances the anchoring effort. (Sinha - OEIS)
W80-02140

DEVICE FOR SOIL IRRIGATION,
Rhone-Poulenc-Textile, Lyons, (France). (Assignee).
Y. Gaudard, H. Guillemaud, and J. Perfetti.
U.S. Patent No 4,162,863, 6 p, 2 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 5, p 1161, July 31, 1979.

Descriptors: *Patents, *Irrigation, *Subsurface irrigation, *Application equipment, Absorption, Moisture, Soil-water-plant relationships, Irrigation efficiency, Hydrophilic textile.

An irrigating device formed from an absorbent product, such as a polymeric pulp or hydrophilic textile contained within a filtering envelope such as a woven, knitted or non-woven fabric is placed in the ground in communication with a source of water which may be above or below ground. The irrigation device provides for a uniform rate of irrigation of the soil in which it is placed, required less water than conventional irrigation devices providing the same overall coverage, and is not subject to clogging or blockage, as with conventional irrigation devices. In one embodiment for preparing the irrigation device, the absorbent product is in the form of a tow of hydrophilic continuous filament and the textile filter envelope is produced in a continuous in-line operation in conjunction with the production of the tow. The irrigation device can be applied to the irrigation of soils to facilitate the growth of plants, trees, crops and the germination of seeds. (Sinha - OEIS)
W80-02149

SAHARA FARMING IRRIGATION PROBLEMS AND REMEDY RECOMMENDATIONS,
H. F. Mirreh.
In: Advances in Desert and Arid Land Technology and Development, Vol 1, ed. by Adli Bishay and Wm. G. MCGinnies, Harwood Academic Pub. p 231-247, 1979, 3 Fig, 10 Tab, 14 Ref.

Descriptors: *Irrigation practices, *Soil physical properties, *Crop response, *Agroclimatology, Irrigation engineering, Irrigation programs, Soil-water-plant relationships, Irrigation systems, Soil Moisture, Evapotranspiration, Arid lands, Sahara, Root zone.

Reviewed are various crop watering problems in the Sahara where severe weather conditions combine with low water supplying soils and limited crop rooting patterns to cause severe water stress and considerable irrigation problems during periods of high evapotranspiration. Techniques both to improve the efficiency of applied fertilizer and irrigation water and to upgrade the water storage capacity of Sahara soils that have been successful in other arid countries are discussed with the conclusion that currently practiced techniques require modification to make them adaptable to Saharan conditions. (Tickes-Arizona)
W80-02209

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOOD PLAIN INFORMATION: KUSKOKWIM RIVER, MCGRATH, ALASKA.
Army Engineer District, Anchorage, AK.
For primary bibliographic entry see Field 2E.
W80-02014

FLOOD PLAIN INFORMATION: DRY CREEK, BOULDER COUNTY-WELD COUNTY, COLORADO.
Army Engineer District, Omaha, NE.
For primary bibliographic entry see Field 2E.
W80-02015

FLOOD PLAIN INFORMATION: SHREVEPORT, LOUISIANA, NO. 2, BRUSH BAYOU AND TRIBUTARIES.
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W80-02016

FLOOD PLAIN INFORMATION: PEARL RIVER, BOGUE LUSA AND COBURN CREEKS VICINITY OF BOGALUSA, LA.
Army Engineer District, Mobile, AL.
For primary bibliographic entry see Field 2E.
W80-02017

FLOOD PLAIN INFORMATION: UPPER WHITE ROCK CREEK, PLANO, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W80-02019

FLOOD PLAIN INFORMATION: MARINE CREEK, FORT WORTH, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W80-02020

FLOOD PLAIN INFORMATION: PARTS I AND II: TAOS COUNTY - NEW MEXICO.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-02021

FLOOD HAZARD ANALYSES: NORTH FORK - NEW RIVER, ASHE COUNTY, NORTH CAROLINA.
Soil Conservation Service, Raleigh, NC.
For primary bibliographic entry see Field 2E.
W80-02030

FLOOD HAZARD ANALYSES: ARARAT RIVER, SURRY COUNTY, NORTH CAROLINA.
Soil Conservation Service, Raleigh, NC.
For primary bibliographic entry see Field 2E.
W80-02031

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX IX-FLOOD CONTROL.
California Region Framework Study Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 196, Price codes: A21 in paper copy, A01 in microfiche. Prepared for Pacific Southwest Inter-Agency Committee, Water Resources Council, June 1971. 478 p, 23 Fig, 15 Tab, 6 Maps, 50 Photographs, 190 Ref.

Descriptors: *Flood control, *Water resources development, *California, *Flood protection, *Flood data, *Multiple purpose projects, *Flood plain management, *Control structures, *Non-structural alternatives, *Oregon, Runoff, Planning, Flooding, Water management, Weather modification, River basins.

This report is part of a study undertaken under the guidance of the U.S. Water Resources Council to evaluate alternative water and related land resources for the California Region, an area consisting of all of California and 7% of Oregon. This appendix presents an evaluation and general appraisal of present and future flood problems of the Region. An overall summary of flood control measures precedes data summaries of the flood control situation in each of the regions 11 subregions. The flood history of the region indicates periodic flooding, particularly during the wetter, winter months. Findings indicate that current flood planning programs and warning systems are well developed, but damages from flooding continue to increase. Considerable population growth between 1965 and 2020 is projected and recurring floods will cause increased damage and loss of life. Future flood control measures for the region should include increasingly comprehensive flood forecasting programs (particularly emphasizing satellite information relay capability), additional studies to evaluate the expanding role of flood plain regulation, increased use of flood control storage, use of levees and channels, and the evaluation of the effects of structural measures on the environment, more detailed studies to integrate all control measures within a single program framework, additional runoff research, and expansion of current flood forecasting and weather modification studies. (Arnold-NC)
W80-02034

WASTEWATER MANAGEMENT ALTERNATIVES FOR THE CLEVELAND-AKRON, THREE RIVERS WATERSHED AREA: TECHNICAL APPENDIX-PHASE I: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5D.
W80-02042

REAL-TIME HOURLY RESERVOIR OPERATION,
California Univ., Los Angeles. Dept. of Engineering Systems.
W. W-G. Yeh, L. Becker, and W. S. Chu.
Journal of the Water Resources Planning and Management Division, ASCE, Vol 105, No WR2, p 187-203, September 1979, 4 Fig, 4 Tab, 64 Ref. OWRT C-7099 No 6209 (4), 14-34-0001-6209.

Descriptors: *Real-time reservoir operation, *Hydroelectric power, *Optimization, *Linear programming, *Dynamic programming, Systems analysis, Operations research, Reservoir operation, *California Central Valley Project, *Real-time decision making.

An hourly optimization model is developed for online use in the operation of the Central Valley Project (CVP) in California. The hourly model is supplemental to monthly and daily optimization models previously developed for the CVP, and maximizes a weighted summation of generated power over a 24-hr period subject to specified plant releases obtained from a daily model, a desired hourly power schedule, and apropriate system and equipment constraints. The procedure has been developed in two phases. Phase I involves a determination of a good feasible policy (a set of releases) throgh an iterated linear programming and adjust process. Phase II uses this feasible policy as a starting policy in an incremental dynamic programming, successive approximations process to derive an optimal policy. CVP operational records of some typical days are compared with the model outputs for these days, and significant improvements are observed.
W80-02160

WATER QUALITY IN THE PROPOSED PROSPERITY RESERVOIR AREA, CENTER CREEK BASIN, MISSOURI,
Geological Survey, Rolla, Mo. Water Resources Div.
J. H. Barks, and W. R. Berkas.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A072 720, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-22, February 1979. 26 p, 1 Fig, 6 Tab, 15 Ref.

Descriptors: *Baseline studies, *Water quality, *Streams, *Pre-impoundment, *Water analysis, Chemical analysis, Water types, Trace elements, Nutrients, Coliforms, Pesticides, Bacteria, Organic wastes, Evaluation, Reservoir sites, Center Creek basin(Mo).

Water in Center Creek basin, Mo., upstream from the proposed Prosperity Reservoir damsite is a calcium bicarbonate type that is moderately mineralized, hard, and slightly alkaline. Ammonia and organic nitrogen, phosphorus, total organic carbon, chemical oxygen demand, and bacteria increased considerably during storm runoff, probably due to livestock wastes. Nitrogen and phosphorus concentrations are probably high enough to cause the proposed lake to be eutrophic. Minor-element concentrations were at or near normal levels in Center and Jones Creeks. The only pesticides detected were 0.01 micrograms per liter of 2, 4, 5-T in one base-flow sample and 0.02 to 0.04 micrograms per liter of 2, 4, 5-T and 2, 4-D in all storm-runoff samples. Fecal coliform and fecal streptococcus densities ranged from 2 to 650 and 2 to 550 colonies per 100 milliliters, respectively, during base flow, but were 17,000 to 45,000 and 27,000 to 70,000 colonies per 100 milliliters, respectively, during storm runoff. Water in Center Creek about 2.5 miles downstream from the proposed damsite is similar in quality to that upstream from the damsite except for higher concentrations of sodium, sulfate, chloride, fluoride, nitrogen, and phosphorus. These higher concentrations are caused by fertilizer industry wastes that enter Center Creek about 1.0 mile downstream from the proposed damsite. (Woodard-USGS).
W80-02234

EFFECTS OF SEEPAGE FROM FLY-ASH SETTLING PONDS AND CONSTRUCTION DEWATERING ON GROUND-WATER LEVELS IN THE COWLES UNIT, INDIANA DUNES NATIONAL LAKESHORE, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
W. Meyer, and P. Tucci.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-300843, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-138, January 1979. 95 p, 38 Fig, 4 Tab, 10 Ref.

Descriptors: *Settling basins, *Ponds, *Fly ash, *Seepage, *Water levels, Groundwater, Groundwater movement, Aquifers, Construction, Dewatering, Model studies, Hydrogeology, Surface-groundwater relationships, Indiana, *Indiana Dunes National Lakeshore, Fly-ash settling ponds.

Part of the Indiana Dunes National Lakeshore shares a common boundary with the Northern Indiana Public Service Company (NIPSCO). This area is underlain by unconsolidated deposits approximately 180 feet thick. NIPSCO accumulates fly ash from the burning of coal in electric-power generating units in settling ponds. Seepage from the ponds has raised ground-water levels above natural levels approximately 15 feet under the

ponds and more than 10 feet within the Lakeshore. NIPSCO is presently (1977) constructing a nuclear powerplant, and construction activities include pumping ground water to dewater the construction site. The company has installed a slurry wall around the site to prevent lowering of groundwater levels within the Lakeshore. Plans call for continuous pumping through at least December 1979. A multilayered digital flow model was constructed to simulate the ground-water system. The model was used to demonstrate the effects of seepage from the fly-ash ponds on ground-water levels. Also, the model indicated a decline of 3 feet or less in the upper sand unit and 5 feet or less in the lower sand unit within the Lakeshore. (Woodard-USGS).
W80-02239

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
For primary bibliographic entry see Field 6E.
W80-02253

THE HAZARDS OF WETLANDS USE,
Colorado Univ., Boulder. Inst. of Behavioral Science.
For primary bibliographic entry see Field 6E.
W80-02254

MINIMIZATION OF CONSTRUCTION IMPACTS ON WETLANDS: DREDGE AND FILL, DAMS, DIKES, AND CHANNELIZATION,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 6B.
W80-02258

WETLAND REHABILITATION,
Environmental Concern, Inc., St. Michaels, MD.
E. W. Garbisch Jr.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 217-219, 1978 15 Ref.

Descriptors: *Marsh, *Rehabilitation, *Technology, *Feasibility, Wetlands, Ecology, Water resources development, Freshwater marshes, Aquatic plants, Value, Costs, Environmental effects, Salt marshes, Economics, Preservation.

Despite the progress that has been made, marsh rehabilitation must be considered a young and developing technology that has been applied mostly to salt water and brackish water areas. Although general guidelines may be helpful, most sites have such unique characteristics that the ultimate design and implementation of the rehabilitation program must be site specific. The costs of marsh rehabilitation depend upon the plant materials used, the planting density, the techniques of planting, the size of the project, whether fertilizer is necessary, whether the project is maintained after planting, the distance of the site from the contractor, and the accessibility of the site. The commonly recognized important marsh functions maximize operationally in an established marsh within 1 to 3 years, depending on the establishment design. There is no indication that these functions are superior in natural as opposed to established marshes. (See also W80-02253) (Howard-Mass)
W80-02287

4B. Groundwater Management

GROUND-WATER RESOURCE MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Inst. of Agriculture and Natural Resources.
C. A. P. Fricke, and D. T. Pederson.
Ground Water, Vol 17, No 6, p 544-549, November-December 1979. 3 Fig, 4 Ref.

Descriptors: *Groundwater, *Water management(Applied), *Groundwater resources, *Nebraska, Water law, Irrigation, Water levels, Pumping, Water supply, Water demand, Water resources, Semiarid climates.

In order to regulate the use of groundwater, State agencies and local government, together with local public participation, have developed a management policy which is now being implemented in Nebraska. A water resource agency, a geological survey, and a local, multi-county governmental unit were combined with several other governmental units to investigate water problems and to guide a variety of vested interests toward a common goal of efficient water resource management. The key government document delegating the authority and guiding the agencies is the Nebraska Ground Water Management Act of 1975. This Act specifies a procedure whereby local residents concerned about misuse and depletion of their groundwater supplies can request that official hearings be held, water supply evaluations be made, and consideration be given by the Nebraska Department of Water Resources to establish what is called a 'control area.' Designation of a control area allows development and enforcement of methods to deal with the water resource problem within that area. The management alternatives provided for by this Act include well spacing, rotation of pumping, allocation of water, and moratoriums on drilling. The Act does not, however, address conjunctive use of surface water and groundwater, guidelines for management policies, and rights to artificially stored groundwater. (Sims-ISWS)
W80-02171

INDUCED GROUNDWATER RECHARGE IN THE GANGES BASIN,
Indian Inst. of Tech., New Delhi.
M. C. Chaturvedi, and V. K. Srivastava.
Water Resources Research, Vol 15, No 5, p 1156-1166, October 1979. 13 Fig, 4 Tab, 21 Ref, 1 Append.

Descriptors: *Groundwater, *Recharge, *Artificial recharge, *Model studies, Mathematical models, Analytical techniques, Rivers, Watersheds(Basins), Water table, Water levels, Drawdown, Pumping, Monsoons, Evapotranspiration, Flow, Streamflow, *India, *Ganges River Basin.

The Ganges basin in India has a serious problem of water availability. The basin area, which is only 1/12 that of the United States, has a population greater than the total U.S. population, and it is increasing at a rate of 2.5% per annum. About 77% of the population is engaged in agriculture, which is totally dependent on irrigation. Almost 85% of rainfall takes place in 2-3 monsoon months. Surface storage possibility is extremely limited, but groundwater recharge appears feasible, since sedimentary alluvial formations extend to depths of thousands of meters. Three alternative schemes of groundwater recharge were proposed. One involves pumping heavily along perennial rivers prior to monsoons so as to lower groundwaters to promote induced groundwater recharge. The second proposes a similar approach along nonperennial rivers. The third involves irrigation during monsoons with groundwater lowered adequately in the nonmonsoon period so that enough induced groundwater recharge takes place to provide adequate supplies for nonmonsoon months. A simulation-optimization model was developed to study the surface flow-groundwater interaction and was applied to study comparative cost effectiveness of the three alternate approaches. Sensitivity analysis was also carried out. It was shown that the third scheme is the most attractive. (Sims-ISWS)
W80-02176

DISTRIBUTION OF NITRATE AND RELATED NITROGEN SPECIES IN THE UNSATURATED ZONE, REDLANDS AND VICINITY, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. M. Klein, and W. L. Bradford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-300926, Price codes: A05 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 79-60, July 1979. 81 p, 28 Fig, 13 Tab, 93 Ref.

Descriptors: *Nitrogen compounds, *Nitrates, *Nitrogen, *Aquifer management, *Water pollution control, Groundwater, Water pollution sources, Fertilizers, Feed lots, Citrus fruits, Irrigation, Infiltration, Soil analysis, Baseline studies, Artificial recharge, Planning, Model studies, Evaluation, California, *San Bernardino County(Calif).

Nitrogen in the unsaturated soil zone in the vicinity of Redlands in San Bernardino County, Calif., has been suspected as the source of nitrate in water from wells. Plans have been made to recharge the aquifer with imported surface water. If this occurs, the rising water table will intercept soluble nitrate in the unsaturated zone. This study was made to quantify and delineate the distribution of the nitrate in the unsaturated zone. Thirteen test holes were drilled in areas of various land uses, and samples of the unsaturated-zone materials were obtained with depth. In 10 of the test holes, the maximum nitrate-nitrogen (N03--N) concentrations occurred within 10 feet of land surface suggesting N03--N sources at the surface. Ranking the test holes according to near-surface N03--N concentrations showed that, of the top six, only two are in irrigated citrus areas. One is in an abandoned feedlot. Of the lowest six, four are in irrigated citrus areas and one is in the Santa Ana River channel. The control test hole ranked fourth suggesting that relatively high N03--N concentrations can occur in near-surface soils even in the absence of human habitation. Analysis according to one conceptual model suggests that raising the water-table altitude by aquifer recharge will intercept N03--N now in the unsaturated zone causing increases in N03--N concentrations in water from wells of up to 48 milligrams per liter. The largest increases will occur in the vicinity of irrigated citrus areas. (Woodard-USGS).
W80-02233

4C. Effects On Water Of Man's Non-Water Activities

HYDROLOGIC DATA FROM URBAN WATERSHEDS IN THE TAMPA BAY AREA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. A. Lopez, and D. M. Michaelis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-301204, Price codes: A04 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 78-125, 1979. 51 p, 17 Fig, 12 Tab, 7 Ref.

Descriptors: *Urban hydrology, *Storm runoff, *Water quality, *Hydrologic data, Rainfall-runoff relationships, Evaporation, Land use, Data storage and retrival, *Tampa Bay area(Fla).

Hydrologic data are being collected in 10 urbanized watersheds located in the Tampa Bay area, Florida. The gaged watersheds have impervious areas that range from 19 percent for a residential watershed in north Tampa to nearly 100 percent for a downtown Tampa watershed. Land-use types, including roads, residential, commercial, industrial, institutional, recreational, and open space, have been determined for each watershed. Rainfall and storm runoff data collected since 1971 for one site and since 1975 for six other sites through September 1976, have been processed. These data are recorded at 5-minute intervals and are stored in the U. S. Geological Survey WATSTORE unit values file. Daily rainfall at 12 sites and daily pan evaporation at one site have been stored in the WATSTORE daily values file. Chemical and biological analyses of storm runoff for six sites, base flow for seven sites, and analyses of bottom material for seven sites are also stored in the WATSTORE water-quality files. Rainfall and storm runoff for selected storms, daily rainfall, and daily pan-evaporation data are summarized in this report. Water-quality analyses of all water-quality samples also are listed. (Woodard-USGS).
W80-02235

PROMISED LANDS, VOLUME 2: SUBDIVISIONS IN FLORIDA'S WETLANDS,
For primary bibliographic entry see Field 6G.

W80-02314

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

TIME SERIES IN M DIMENSIONS: THE ONE-DIMENSIONAL CASE: POLLUTION IN THE CHICAGO SANITARY AND SHIP CANAL,
Western Illinois Univ., Macomb. Dept. of Mathematics.
D. B. Campbell, and D. J. Schaeffer.
Environmental Management, Vol 3, No 3, p 283-288, 1979. 6 Fig, 6 Tab, 11 Ref, 1 Append.

Descriptors: *Pollutants, *Monitoring, *Model studies, *Water pollution, *Nonstationary time series, *M-dimensional time series, *Chicago sanitary and ship canal, Dissolved oxygen, Dissolved solids, Nitrates, Nitrites, Ammonia, Sampling, Mathematical studies, Environmental monitoring, Water quality, Pollution, Regression model.

In order to examine the changes occurring at sampling stations on the Chicago Sanitary and Ship Canal (CSSC) a nonstationary time-series model is used. The Canal starts at Lake Michigan and runs into the Illinois River below Joliet. Primary indicators of the environmental health of the waterway are dissolved oxygen, ammonia, nitrates and nitrites, dissolved solids and coliform bacteria, dissolved oxygen being the most important. In this model the effects of several spatially and temporally separated points on some point of interest are examined. In order to be useful to, and be used by, the environmentalist, the model must be simple, insensitive to extremes, and responsive to changes occurring in the system. This method is insensitive to extreme values but responsive to overall changes in the system. The model successively predicted the behavior of such parameters as total dissolved solids and ammonia. The data, from 26 observations, were collected under difficult conditions and no more frequently than once a month and, particularly during the winter, weather conditions precluded the collection of any samples. Environmentally significant results were obtained. Accurate predictions of downstream sites could be made using 2-month-old data from upstream stations. From this it was determined that improvements in water quality, such as higher dissolved oxygen levels at the upstream end of the Canal, will significantly increase dissolved oxygen levels throughout the Canal. (Iervolino-NC)
W80-02023

PROFILE: ILLINOIS REDESIGNS ITS AMBIENT WATER QUALITY MONITORING NETWORK,
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.
T. R. Wallin, and D. J. Schaeffer.
Environmental Management, Vol 3, No 4, p 313-319, 1979. 2 Tab, 23 Ref.

Descriptors: *Illinois, *Water quality control, *Monitoring, *Ambient water quality monitoring network, Ambient water quality, Lake Michigan(IL), Water analysis, Sampling, Water properties, Assessment, Water pollution, Cooperative agreements, Water pollution control.

Illinois' monitoring network has grown since 1957 from 150 stations to a network of 590 stations. The objectives of the Ambient Water Quality Monitoring Network (AWQMN) are: 1) to establish baselines of water quality; 2) to characterize and define trends in the physical, chemical, and biological condition of the state's surface waters; 3) to provide for a continuing assessment of water pollution control programs; 4) to identify and quantify new or existing water quality problems or problem areas; and 5) to act as a trigger mechanism for intensive surveys or other appropriate actions. Because objectives of the AWQMN were defined before it was designed, siting factors could be selected and priorities determined to best achieve those objectives. Ten site selection criteria were established, including at least one sampling site in each segment, networks of about 220 stations, availability of flow data, and maintenance of current data files. Sites with similar characteristics should be identified and grouped for analysis purposes. Each station can, therefore, be considered in one, two or more of seven sub-networks of the total AWQMN plan. The frequencies of sample collection are guided by the objectives of the AWQMN. Types of sampling include grab sampling, composite monitoring and automated continuous monitoring. The Illinois Environmental Protection Agency and the U.S. Geological Survey have a cooperative program under which USGS monitors a portion of the network and provides flow data at most network stations as well as extensive manpower training, equipment, data processing, and program quality control. Informal agreements with other agencies have permitted reduction in monitoring efforts required by the Illinois EPA. (Iervolino-NC)
W80-02024

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. LOWER COOK INLET INTERIM SYNTHESIS REPORT.
Science Applications, Inc., Boulder, CO.
NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Report July 1979. 257 p, 220 Ref.

Descriptors: *Resources development, *Environmental effects, *Baseline studies, Water pollution effects, Hazards, Transport, Biota, Oil pollution, Alaska, Sites, *Outer continental shelf, Cook inlet.

The Interim Edition of the Lower Cook Inlet Synthesis Report is intended to present a multidisciplinary overview of information relevant to possible Alaskan Outer Continental Shelf oil and gas development. OCSEAP-supported research is still continuing in the Lower Cook Inlet region, making additional relevant information continually available. A synthesis chapter is provided to tie the scientific and technical information chapters together. It presents a picture of the operation and vulnerability of the environmental system in such a way that the user, or 'decision maker', will have a sound basis for tract selection, location of pipelines or other facilities, stipulations, and regulations, or know where problems exist. (See W80-02054 thru W80-02059) (NOAA)
W80-02053

METHODS OF UTILIZATION OF WASTE EFFLUENTS FROM MINERAL FERTILIZERS PLANTS IN CARP FRY CULTURES,
Wyzsza Szkola Rolnicza, Szczecin (Poland). Dept. of Hydrozoology.
L. Szlauer.
Polskie Archiwum Hydrobiologii, Vol 26, No 1/2, p 231-246, 1979. 2 Fig, 6 Tab, 9 Ref.

Descriptors: *Fertilizers, *Chemical wastes, *Fish farming, Fry, Carp, Industrial wastes, Zooplankton, *Phosphates, Nitrogen, Growth rates, Nutrients, Aquiculture, Daphnia, Phytoplankton.

Zooplankton and carp fry were cultured in chemical waste effluent containing up to 59.1 mg PO4 /1 and 86.1 mg N/1. A 100 per cent survival of fish and an increment in fish weight amounting to 1526 kg/ha was obtained in the course of 77 days of culturing carp fry in a pond without flow and with additional feeding with zooplankton cultured in waste effluent. Reduction of phosphates in waste effluent used in the cultures was up to to 90 per cent (on the average 2.97 mg PO4 /1/24h). (Deal-EIS)
W80-02078

EFFECT OF CRUDE OIL AND DETERGENT 'SOLO' ON THE ACTIVITY OF SOME HYDROLASES IN HEMOLYMPH OF CRAB RHITHROPANOPEUS HARRISI,
Medical Academy, Gdansk (Poland). Dept. of Biology.
G. Drewa, T. Dabrowska, Z. Zbytniewski, and F. Patuch.
Polskie Archiwum Hydrobiologii, Vol 26, No 1/2, p 205-211, 1979. 4 Fig, 14 Ref.

Descriptors: *Enzymes, *Inhibition, *Oil, *Detergent, *Crabs, Animal metabolism, Animal physiology, Toxicity, Cruataceans, Biochemistry, Mortality, Chemical properties, Bioassay, *Surfactants, *Crude oil.

Activities of acid phosphatase and arylsulphatase in hemolymph of the crab Rhithropanopeus harrisi incubated for 2 weeks in solutions of curde oil and detergent 'SOLO' at concentrations of 50, 100 and 200 ppm were determined. Both crude oil and detergent decreased the activity of the investigated enzymes in crab hemolymph. Changes in the enzymic activity are probably due to the effect of the investigated pollutants on biological membranes and to their inhibition of lysosomal hydrolases. (Deal-EIS)
W80-02079

PREPARATION AND DETERMINATION OF CHLORAMINES FOR WATER TOXICOLOGY,
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergentics.
M. Prus-Kaniewska, and H. Sztrantoicz.
Poliskie Archiwum Hydrobiologii, Vol 26, No 1/2, p 191-204, 1979. 3 Fig, 2 TAb, 17 Ref.

Descriptors: *Chemical properties, *Chlorination, *Waste treatment, Chemical reactions, Water temperature, Laboratory tests, Bioassay, Sodium compounds, Nitrogen compounds, Chorine, *Chloramines.

Mono-, di- and trichloramines were prepared using solutions of sodium hypochlorite of different concentrations and ammonium chloride with constant nitrogen concentration of 1.0 mg N/1. Various factors exerting an effect on the stability of chloramines (temperature, light, time) were studied. Contents of the different chloramines were determined by titration with Mohr's salt in the presence of orthotolidine. The stability of the obtained chloramine solutuions was found to be high, irrespective of light and temperarures. Curves of the obtained solutions were very consistent with the typical curve of chloramine formation. (Deal-EIS)
W80-02082

INFUENCE OF TEMPERATURE ON MORPHOLOGY AND PHYSIOLOGY OF SALMONID EMBRYOS, LARVAE AND ALEVINS,
Tikhookeanskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva i Okeanografii, Petropavlovsk-Kamchatskii (USSR).
L. P. Ryzhkov.
Polskie Archiwum Hydrobiologii, Vol 26, No 3, p 397-425, 1979. 15 Fig, 14 Tab, 57 Ref.

Descriptors: *Water temperature, *Growth rates, *Salmonids, Oxygen requirements, Atlantic salmon, Rainbow trout, Animal metabolism, Fish physiology, Growth stages, Fry, Larval growth stage, Embryonic growth stage, Energy budget.

The influence of temperature on morphogensis rate, growth rate, oxygen consumption rate as well as on energy budget of 5 species of freshwater salmonid fishes (Salmo salar morpha sebago, Salmo ischchan typicus, Salmo ischchan gegarkuni, Salmo ischchan aestivalis and Salmo gairdneri) has been investigated for several years. Temperature increases stimulate the above processes, while a decrease in temperature makes them progress more slowly. Energy budgets are well balanced in the range of optimal temperatures. Deviations of temperature from the optimal temperatures. Deviations of temperature from the optimal range disturb the coordingation of energy budgets. The efficiency of utilisation of consumed food for growth decreases. (Deal-EIS)
W80-02085

THE EFFECT OF STARVATION AND TEMPERATURE CONDITIONS ON VENDACE (COREGONUS ALBULA L.) LARVAE,
Agricultural and Teachers Univ., (Poland). Inst. of Applied Biology.

B. Jezierska, M. Korwin-Kossakowski, and G. Jowko.
Polskie Archiwum Hydrobiologii, Vol 26, No 3, p 387-395, 1979. 3 Fig, 20 Ref.

Descriptors: *Water temperature, *Toxicity, *Growth rates, Larval growth stage, Feeding rates, Mortality, Fry, Fish physiology, Fish management, Oxygen requirements, Fish diets, *Vendace, *Coregonus, Whitefish.

A determination was made of the effect of various thermal conditions (constant temperatures 10C and 18C as well as temperatures varying cyclically within 8C-18-8C) on larvae of vendace. At 18C the rate of morphogenesis was accelerated, but simultaneously larval mortality was high at this temperature. At 10C and at cyclically varying temperature the survival and development of larvae were similar. Furthermore, we determined the effect of various starvation periods on larvae kept at 10C; the 'point of no return' (PNR) was established at the 11th day after hatching. (Deal-EIS)
W80-02086

PHOTOPERIODIC ACCLIMATION AND CIRCADIAN VARIATIONS IN TOLERANCE OF JUVENILE RANBOW TROUT (S/ LMO GAIRDNERI) TO ZINC,
British Columbia Research Council, Vancouver. Div. of Applied Biology.
D. J. McLeay, and J. R. Munro.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 552-557, 1979. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Biorhythms, *Zinc, *Toxicity, *Photoperiodism, Fish physiology, Rainbow trout, Juvenile growth stage, Seasonal, Mortality, Diel migration, Heavy metals, Bioassay.

The intent of this study was to determine if circadian variations occur in the tolerance of juvenile rainbow trout to an acutely lethal concentration of zinc. Further, the influence of photoperiodic acclimation on this tolerance was examined since seasonal or photoperiodic acclimation may alter hormonal rhythms and toxic responses at a particular time of day; thus complexing the potential variations in acute lethal or sublethal aquatic toxicity data. Circadian variations in tolerance to zinc were evident. Fish acclimated to a natural photoperiod showed periods of maximum tolerance at 1200, 1600-1800 and 2400-0200 h; and periods of maximum sensitivity at 1400 and 2000 h. Those acclimated to a fixed summer photoperiod showed maximum tolerances at 1800 and 0600-0800 h; and maximum sensitivities at 1400 and 0400 h. (Deal-EIS)
W80-02087

DETECTION LIMITS OF A BIOLOGICAL MONITORING SYSTEM BASED ON FISH RESPIRATION,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands). Chemical Biological Div.
W. Slooff.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 517-523, 1979. 1 Fig, 3 Tab, 12 Ref.

Descriptors: *Monitoring, *Respiration, *Bioassay, Toxicity, Fish physiology, Rainbow trout, Analytical techniques, *Cadmium, *Copper, Organic compounds, Phenols, Laboratory tests, Cyanide, Xylene, Toluene , Pentachlorophenol.

In order to assess the detection limits of a method of monitoring fish respiratory rate, fish were exposed to one of thirteen organic or inorganic compounds at one of three different concentrations. The monitoring technique employs dual external electrodes to detect respiratory activity. In most cases the toxicants caused an increase in the breathing rate of the fish at sublethal concentrations. These responses were obtained more frequently during the dark photoperiod. The system was found to be much more sensitive than the 48th LC50. Detection thresholds varies from 1 to 30% of the 48h LC50 toxicant concentration. (Deal-EIS)
W80-02088

EFFECTS OF A THERMAL DISCHARGE ON THE MORTALITY OF COPEPODS IN A SUBTROPICAL ESTUARY,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
R. W. Alden, III.
Environmental Pollution, Vol 13, p 3-19, 1979. 3 Fig, 2 Tab, 40 Ref.

Descriptors: *Copepods, *Mortality, *Heated water, Water temperature, Thermal pollution, Thermal stress, Lethal limit, Estuarine environment, Adaptation, Evolution, Heat resistance, Tropical regions, Animal populations, Seasonal, Powerplants, Thermal discharges.

Experimental field treatments were employed to examine the thermal mortalities of copepods exposed to the heated effluents of a power generating plant located on a subtropical estuary. Significant lethal effects were observed for all species studied, with mass mortalities occurring during the warmest months of the year. Of the seven species examined, the copepods identified as estuarine species had steeper mortality curves and higher upper lethal thermal limits than the more neritic forms. The estuarine species have apparently evolved the ability to live in subtropical areas under temperature conditions very close to their upper thermal limits. Coastal species, on the other hand, exhibit a greater variation in temperature sensitivity so thermal additions in subtropical estuaries could be very significant in limiting their distribution and abundance. (Deal-EIS)
W80-02091

PHYSIOLOGICAL AND ENVIRONMENTAL CONSTRAINTS IN THE ECOLOGY OF THE PLANKTONIC DINOFLAGELLATE CERATIUM HIRUNDINELLA,
Freshwater Biological Association, Windermere (England).
G. P. Harris, S. I. Heaney, and J. F. Talling.
Freshwater Biology, Vol 9, p 413-428, 1979. 8 Fig, 1 Tab, 60 Ref.

Descriptors: *Dinoflagellates, *Ecology, *Habitats, Thermal stratification, Dissolved oxygen, Photosynthesis, Chlorophyll, Plankton, Aquatic microorganisms, Epilimnion, Light intensity, Light penetration, Aquatic populations, Nitrogen, Seasonal, Esthwaite water.

Constraints upon the vertical distribution of a population of Ceratium hirundinella, in a productive English lake during the summer stratification of 1976, are considered. They are interpreted in relation to vertical gradients of temperature, dissolved oxygen and irradiance, and to rates of photosynthesis and respiration measured as oxygen exchange in long- and short-term exposures. The motile cells tended to aggregate at an intermediate depth in the epilimnion, associated with a relative irradiance level of c. 10%. Higher irradiances, and conditions below the oxycline, were apparently unfavourable, but the intervening layer was severely compressed at the height of summer stratification, when concentrations of inorganic nitrogen were also minimal. Thus the population apparently passed through a critical period, at which the cellular content of chlorophyll-a was much reduced. The preferred irradiance level in the lake corresponded to that at which measured rates of net photosynthesis were maximal. Increased rates of oxygen evolution were measured at higher irradiances in very short exposures; this behaviour may be of importance to cells experiencing vertical movement in nature. (Deal-EIS)
W80-02092

ADAPTATION OF A RECIRCULATING FISH CULTURE SYSTEM TO SALINITY CHANGE,
Biologische Anstalt Helgoland, Hamburg (Gemany, F.R.).
H. Rosenthal, and G. Otte.
Meeresforschung, Vol 27, No 3, p 203-206, 1979. 2 Fig, 10 Ref.

Descriptors: *Salinity, *Trickling filters, Ocidation, *Salt tolerance, *Aquiculture, Biochemical oxygen demand, Filtration, Ammonium, NItrification, Biodegradation, Bacteria, Methodology, Waste treatment, Fish establishment, Fish hatcheries.

The reaction of a biological filter (integrated in a recycling sytstem for fish culture) to salinity change (2 o/oo S/d from 0 to 8 o/oo) was investigated. Theoxidation of easy digestible carbon compounds (measured as BOD) was unaffected whereas the decomposition processes for low biodegradable substances ceased during salinity increase but was reactivated slowly after the final salinity level had been reached. Nitrification was significantly affected during the first 3 days with an ammonium peak followed by a nitrate maximum 12 h later. While ammonium oxidation regained its former efficiency during the period of salinity increase, nitrite oxidation was still unbalanced 6 days after the final salinity had been reached. (Deal-EIS)
W80-02095

DEVELOPMENT OF ALGAE IN PONDS TREATED WITH FOSCHLOR AND IN PONDS WITH CONTROLLED TIME OF FILL,
Instytut Rybactwa Srodladowego, Zibieniec (Poland). Pond and River Dept.
M. Januszko.
Polskie Archiwum Hydrobiologii, Vol 26, No 3, p 247-256, 1979. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Pesticide toxocity, *Aquatic algae, *Fish farming, Ponds, Fish management, Chlamydomonas, Scendesmus, Chlorella, Diatoms, Dominant, Organisms, Growth rates, Inhibition, Biomass, Algal control.

A study was made on the effect of foschlor R-20 1 mg AI/1 on the quantity and biomass of algae in ponds. Foschlor first reduced rapidly and then stimulated the development of Stephanodiscus Hantzchii and Cryptomonas rostrata, Chlamydomonas sp. and Chlorella minutissima were affected slighter. It seems that Chlamydomonadacea, Scenedesmus quadricauda and Nitschia palea remained unaffected. Since the selective action period was rather short, foschlor did not change the succession of algal species. The succession was very similar both in the treated and control ponds. (Deal-EIS)
W80-02096

EFFECT OF COPPER SULFATE AND SODIUM PENTACHLOROPHENATE ON ADENINE AND ADENOSINE PHOSPHATES IN LYMNAEA LUTEOLA (MOLLUSCA: GASTROPODA),
Sri Venkateswara Univ., Tirupati, (India). Dept. of Zoology.
V. D. Chowdary, P. V. Rao, and R. Narayanan.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 615-619, 1979. 1 Tab, 20 Ref.

Descriptors: *Copper sulfate, *Toxicity, *Snails, *Enzymes, Sodium compounds, Inhibition, Animal metabolism, Proteins, Biochemistry, Chemical analysis, Pesticides, Mode of Action, Phosphates, *Sodium Pentachlorophenate, *Tissue analysis.

Although copper sulfate and sodium pentachlorophenate have been used as molluscicides for many years little is known of its exact modes of action. In this research the effects of these two compounds on adenylate compounds in the freshwater snail (Lymnaea luteola) were studied. Specimens were exposed to either 2 ppm copper sulfate for 15 hours or 2 ppm sodium pentachlorophenate for 10 hours (plus controls). Following exposure the animals were analyzed for adenine and adenpsine phosphatease activity. Snails exposed to CuS04 for 15 h could maintain 92% of the normal ATP level, while it was 72% for NaPCP treated snails. In the CuS04 treatment the ATP/ADP ratio remained unchanged while the ATP/AMP ratio increased. In NaPCP treatment both the parameters decreased. The adenine+adenosine fractions decreased on CuS04 treatment and increased on NaPCP treatment. (Deal-EIS)
W80-02097

THE INFLUENCE OF AMMONIA WATER ON BACTERIA, PLANKTON AND BOTTOM FAUNA OF PONDS, (IN POLISH),
Instytut Rybactwa Srodiadowego. Warsaw (Poland).
E. Grygierek, M. Januszko, D. Kruger, and B. E. Wasilewska.
Roczniki Nauk Rolniczych, Vol 99, No 1, p 212-240, 1978. 11 Fig, 2 Tab, 9 Ref.

Descriptors: *Ammonia, *Toxicity, *Plankton, *Bacteria, *Benthic fauna, Phytoplankton, Zooplankton, Mortality, Water chemistry, Ponds, Seasonal, Growth stages, Hydrogen ion concentration, Water temperature, Mode of action.

Studies were carried out on the influence of ammonia water introduced in amounts of 1.-1.5 tons/ha on the biocenosis of a pond. From 0.4 to 37 mg/1 of non-ionized ammonia- the toxic fraction of ammonia - was obtained in particular cases. Amounts of 2.5-2.8 mg/1 of non-ionized ammonia were found to be lethal for phytoplankton and zooplankton. No influence of the amount of ammonia water introduced on bottom fauna was observed. No changes in the amount of bacteria in the water took place in winter, whereas the amount of bacteria increased in the pond bottom. Ammonia water can be used as a measure for changing the biocenosis structure toward rejuvenation of complexes, but has no disinfecting effect. (Deal-EIS)
W80-02099

AN EVALUATION OF THE USEFULNESS OF A POND ENVIRONMENT WITH HEATED WATER FOR REARING OF FISH,
Instytut Rybactwa Srodladowego, Warsaw (Poland).
E. Grygierek, M. Januszko, D. Kruger, K. Migala, and B. E. Wasilewska.
Roczniki Nauk Rolniczych, Vol 99, No 1, p 97-119, 1978. 3 Fig, 5 Tab, 56 Ref.

Descriptors: *Heated water, *Toxicity, *Aquatic populations, *Aquiculture, Trophic level, Productivity, Thermal pollution, Cooling waters, Powerplants, Water temperature, Fish management, Zooplankton, Phytoplankton.

Studies were conducted on the influence of heated water from an electric power plant on the biocenosis of fish ponds. It was found that at a water temperature of up to 22-23C biological and physico-chemical parameters are not influenced. However a water temperature of more than 23C over a longer period of time results in unfavourable changes in the structure of the biocenosis due to the excessively high activity of consumers with respect to the regeneration possibilities of their prey. Recommendations are made on the type of pond conditions best suited to culturing yearling fish. (Deal-EIS)
W80-02101

EFFECTS OF TOXIC AMOUNTS OF DIETARY ZINC ON THE GROWTH AND BODY COMPONENTS OF RAINBOW TROUT AT TWO LEVELS OF CALCIUM (IN JAPANESE).
Freshwater Fisheries Research Lab., Tokyo (Japan).
H. Takeda, and Y. Shimma.
Bulletin of the Freshwater Fisheries Research Laboratory, Vol 27, No 2, p 103-110, 1977. 1 Fig, 3 Tab, 18 Ref, 1 App. (English summary).

Descriptors: Metals, *Zinc, *Calcium, *Aquiculture, Protein, *Fish diets, Fish physiology, *Rainbow trout, Freshwater fish, Dietary zinc, Zinc accumulation, Magnesium.

Nine lots of rainbow trout fingerlings were raised on casein diets for 6 weeks in order to determine their response to high levels of dietary Zn (50-2,000 ppm) at two levels of dietary Ca (0.01 and 0.5%). Calcium was also added to the SCP diet (300 ppm Zn) composed mainly of yeast grown on acetic acid. Zinc oxide and Ca-lactate were used as the sources of the two minerals. The fish on the casein diets showed inferior growth and feed efficiency only when the diet contained 2,000 ppm of Zn and 0.01% Ca, while those on the 2,000 ppm Zn diet with 0.5% Ca supplement grew as well as the other lots. Other protective effects of supplemental Ca against the adverse effects of excess amounts of dietary Zn were observed clearly in the Zn concentrations in the bone and the whole body in the case of 1,000 ppm Zn diets. The results from 400 ppm to 700 ppm, over which the accumulation of Zn in the fish body was accelerated. Addition of Ca to the SCP diet of 300 ppm Zn showed no beneficial effect on fish growth at all. (Deal-EIS)
W80-02102

AN ATTEMPT TO DISINFECT FISH PONDS WITH AMMONIA WATER (IN POLISH),
Instytut Rybactwa Srodladowego, Warsaw (Poland).
S. Danielewski.
Roczniki Nauk Rolniczych, Vol 99, No 1, p 69-80, 1978. 5 Fig, 3 Tab, 10 Ref.

Descriptors: *Ammonia, *Toxicity, *Disinfectants, Aquiculture, Ponds, Water chemistry, Hydrogen ion concentration, Water temperature, Fishkill, Benthic fauna, Carbonates, Calcium, Nitrates, Nutrients, Seasonal, Fish management, Water quality.

Possibilities of using ammonia water for disinfecting fish ponds were tested. Disinfecting actions of ammonia water consist of toxic effect of ammonia upon living organisms but not an increase of the pH value noted in the case of NH4ON. In soft and alkaline waters, as also in increased temperatures, ammonia water is characterized by a stronger toxic effect. Dosage of one ton of 20% N ammonia water per 1 ha of pond destroys the fishes and also partly lower water organisms. In autumn and winter the decrease of ammonia content to pretreatment levels lasted two months, in spring - one month, and in summer even less. Introduced amounts of NH3 resulted in changes in the water chemistry: drop of carbonates and calcium, increase of the pH value and nitrate content. Ammonia water used for disinfection also had fertilizing effects. (Deal-EIS)
W80-02103

THE SENSITIVITY OF FISH EMBRYOS TO THE EFFECT OF TOXICANTS,
Moscow State Univ. (USSR). Special Topics Lab.
O. P. Danil'chenko.
Journal of Ichthyology, Vol 7, No 3, p 455-463, 1977. 5 Fig, 2 Tab, 31 Ref.

Descriptors: *Toxicity, Bioassay, Reproduction, *Fish eggs, Water pollution effects, Methods, *Organic metal compounds, Metals, Triethyl stannic chloride, Pentachlorophenol, Yellow Perch, Sturgeons, *Fish embryos, Hatching success, Early developmental stages, Juvenile fish, Juvenile growth stages, Salicyl anilid.

An investigation was made of the embryonic development of teleosts and sturgeons in solutions of various toxicants and of the reversability of the effect of lethal concentrations of triethyl stannic chloride. It was demonstrated that fish embryos are simultaneously highly resistant to the action of the toxicant and highly sensitive to it. The resistance of fish eggs to the action of toxicants should be understood as the possibility of completing development at relatively high concentrations. The sensitivity of fishes in the embryonic development period to the action of toxicants is manifested as various deviations from the control in embryos, prolarvae and larvae when they develop in nonlethal solutions of a toxicant. (Katz-EIS)
W80-02104

THE INFLUENCE OF INCREASED O2 CONCENTRATIONS ON THE SURVIVAL AND HATCHING OF THE EMBRYOS OF THE BREAM, ABRAMIS BRAMA,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
M. V. Gulidov, and K. S. Popova.
Journal of Ichthyology, Vol 17, No 1, p 174-177, 1977. 2 Fig, 4 Tab, 5 Ref.

Descriptors: *Oxygen, *Aquiculture, *Fish physiology, *Supersaturation, Laboratory tests, Bioassay, Freshwater fish, Bream, Fish eggs, Fish farming, Fish reproduction, Growth, Times of hatching.

A study was conducted to determine the effect of oxygen supersaturation on the survival and hatching of the bream, Abramis brama. The percent of normal embryos that hatched was similar at saturation 9.2 ppm D.O. and at supersaturation 17.6 and 33.7 ppm D.O. Embryos were largest at 33.7 ppm D.O. At all oxygen concentrations there was a similarity of developmental defects in abnormal embryos (Katz-EIS)
W80-02105

TEMPERATURE DEPENDENCE OF ACTIVE METABOLISM AND SWIMMING SPEED OF THE BAIKAL GRAYLING, THYMALLUS ARCTICUS BAICALENSIS,
Akademiya Nauk SSSR, Novosibirsk. Inst. of Physiology.
A. Ya. Stolbov, and Yu. S. Alikin.
Journal of Ichthyology, Vol 17, No 1, p 178-179, 1979. 1 Tab, 6 Ref.

Descriptors: *Water temperature, *Fish physiology, Biochemistry, Fish behavior, Oxygen, *Oxygen requirements, Grayling, Laboratory tests, Active metabolism, *Swimming speed, Temperature, Temperature effects.

The rate of general metabolism in fish at rest depends directly on the temperature of the environment. The influence of temperature on oxygen consumption of the Baikal grayling at different speeds of swimming was investigated. It was determined that energy expenditure on the performance of external mechanical work during the swimming of the grayling at different speeds of swimming was investigated. It was determined that energy expenditure on the performance of external mechanical work during the swimming of the grayling does not depend on water temperature. (Katz-EIS)
W80-02106

AN ASSESSMENT OF KNOWLEDGE CONCERNING THE FATE AND EFFECTS OF PETROLEUM HYDROCARBONS IN THE MARINE ENVIRONMENT,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
J. W. Anderson.
In: Marine Pollution, Functional Responses. (Vernberg, W. B., Calabrese A., Thurberg F.P., and Vernberg, F. J., Eds, Academic Press, NY.). p 3-21, 1979. 37 Ref.

Descriptors: *Oil, *Oil spills, *Water pollution effects, Path of pollutants, *Toxicity, *Mortality, Bioassay, Laboratory tests, On site investigations, Biochemistry, Animal physiology, Animal biochemistry, Petroleum hydrocarbons, Oysters, Monitoring, Tissue contamination, Bioaccumulation.

The amount of data accumulated from laboratory and field investigations regarding the environmental effects of petroleum hydrocarbon spills allows a good understanding of this problem. Considerable knowledge is available regarding the acute toxicity and the effects of sublethal concentration of petroleum on a variety of vertebrate and invertebrate organisms. The uptake and release of petroleum hydrocarbons by marine and estuarine molluscs suggests their use for field monitoring of sediment-bound petroleum hydrocarbons by aquatic organisms. (Katz-EIS)
W80-02107

THE EFFECT OF NAPHTHALENE ON SYNTHESIS OF PEPTIDE ANTIFREEZE IN THE BERING SEA SCULPIN, MYOXOCEPHALUS VERRUCOSUS,
Illinois Univ. at Urbana-Champaign. Dept. of Physiology and Biophysics.
A. L. DeVries.
In: Marine Pollution, Functional Responses, W. B. Vernenberg, A. Calabrese, F. P. Thurberg, and F. J. Vernberg, Eds. Academic Press, NY. p 54-67,

1979. 2 Fig, 4 Tab, 17 Ref.

Descriptors: *Oil, Oil spills, *Water pollution effects, Path of pollutants, *Marine fish, Biochemistry, Fish physiology, Animal pathology, Laboratory tests, Bioassays, Petroleum hydrocarbons, *Napthhalene, Chemical analysis, Kidney function.

A study was made of the effect of petroleum hydrocarbon naphthalene on the physiology and biochemistry of selected Bering Sea fishes at lethal and sublethal concentrations. This substance appears to accumulate in the liver so a study was made to determine its effect on liver protein synthesis. Laboratory experiments indicated that although there was cellular determination, the lives has a large synthetic capacity that can handle the synthetic requirements of both the mixed function oxidase system and the plasma proteins at the same time. (Katz-EIS)
W80-02108

PESTICIDES: THEIR IMPACT ON THE ESTUARINE ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
D. R. Nimmo.
In: Marine Pollution, Functional Responses, W. B. Vernberg, A. Calabrese, F. P. Thurberg, F. J. Vernberg, Eds. Academic Press, NY. p 259-270, 1979. 1 Tab, 37 Ref.

Descriptors: *Insecticides, Pesticides, Aroclor, *Polychlorinated biphenyls, *DDT, DDE, Estuaries, Chlorinated hydrocarbon pesticides, *Environmental effects, Pyrethroids, Animal physiology, Animal pathology, Herbicides.

The impacts of synthetic organic pesticides on the estuarine environment is discussed. It is observed that pesticides, particularly DDT and its metabolites are still observed six years after large scale use ceased in one watershed. The longevity of persistent pesticides, PCB, in an estuary has been demonstrated in oysters. New pesticides belonging to different chemical groups are being developed and used and knowledge regarding their environmental impacts should be accumulated and applied. (Katz-EIS)
W80-02109

COMPARATIVE METABOLISM OF PARATHION BY INTERTIDAL INVERTEBRATES,
California Univ., Davis. Dept. of Environmental Toxicology.
R. L. Garnas, and D. G. Crosby.
In: Marine Pollution, Functional Responses, W. B. Vernberg, A. Calabrese, F. P. Thurberg, and F. J. Vernberg, Eds. Academic Press, NY. p 291-305, 1979. 3 Fig, 2 Tab, 30 Ref.

Descriptors: Bioassay, Toxicity, *Biochemistry, *Animal physiology, Mussels, Molluscs, Benthos, Marine animals, Insecticides, *Parathion, *Organophosphorous pesticides, Starfish, Sea anemone, Laboratory tests, Absorption, Metabolism, Metabolites.

A laboratory study was made of the metabolism of parathion by the sea star, the California mussel, the black turban snail and the sea anemone. Using radioactive techniques the uptake of the pesticide by the various organisms was correlated. The subsequent metabolism and degradation of the parathion was observed and measured. The metabolism of the pesticide involved typical metabolic pathways of oxidation, reduction and hydrolysis. (Katz-EIS)
W80-02110

MULTIPLE FACTOR INTERACTIONS AND STRESS IN COASTAL SYSTEMS: A REVIEW OF EXPERIMENTAL APPROACHES AND FIELD IMPLICATIONS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
R. J. Livingston.
In: Marine Pollution, Functional Responses, W. B. Vernberg, A. Calabrese, F. P. Thurberg, F. J. Vernberg, Eds. Academic Press, NY. p 389-414, 1979. 8 Fig, 1 Tab, 64 Ref.

Descriptors: *Toxicity, *Bioassay, *Water temperature, Water quality, *Salinity, Estuaries, Apalachicola Bay, Florida, Stress, Chlorine, Estuarine environment, Animal groupings, Animal populations, Stress, Benthos, Species diversity, Microcosms, Simulated ecosystems.

An attempt is made to extrapolate toxicity bioassay data to field situations where environmental response depends upon more than one factor. A critical review is made of multiple factor interactions with particular attention to the nature of stress in estuarine and coastal systems. The complexity of interacting factors is made evident by recent studies concerning the fate and effects of chlorine in coastal systems. The chlorine problem involves at least environment persistence of the substance, identification of degradation products, results of toxicity bioassays, the determination of appropriate water quality parameters and the design of experimental approaches that will assist in provided useful action. Studies in the Apalachicola estuary are used to provide illustrative data. (Katz-EIS)
W80-02111

TEST OF A MODEL FOR PREDICTING KEPONE ACCUMULATION IN SELECTED ESTUARINE SPECIES,
Environmental Research Lab., Gulf Breeze, FL.
L. H. Bahner, and J. L. Oglesby
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 221-231, 1979. 6 Fig, 1 Tab, 7 Ref.

Descriptors: *Pesticide kinetics, *Pesticide residues, Bioassay, Oysters, Shrimp, Crabs, Food chains, Absorption, Mathematical models, Chemical properties, Water chemistry, Estuarine environment, Animal metabolism, Analytical techniques, Path of pollutants, *Kepone, *Depuration, *Bioconcentration.

Extensive testing has shown that Kepone is rapidly accumulated by estuarine animals when administered in water or food. Flow-through laboratory experiments with oysters, shrimp, crabs, and fish indicate that the food-chain transfer of Kepone is important in predicting Kepone residues in estuarine organisms. The rates of Kepone movement through estuarine organisms were previously unknown; rates of uptake and depuration by these organisms were determined with a regression model that describes mathematically the uptake and depuration of Kepone by these organisms. The model describes biological data as a single equation, thus allowing variations, due to many physical, chemical, biological, and random-error factors, to be analyzed simultaneously. The direct application of this model to cautious extrapolation will aid administrative decisions that affect water quality. The rates calculated by this single-species model can be also used in developing models that can predict the long-term fate of Kepone or of other pollutants in an estuarine environment. (Deal-EIS)
W80-02113

CONSIDERATIONS IN ASSESSING THE POTENTIAL FOR, AND SIGNIFICANCE OF, BIOMAGNIFICATION OF CHEMICAL RESIDUES IN AQUATIC FOOD CHAINS,
EG and G Bionomics, Wareham, MA.
K. J. Macek, S. R. Petrocelli, and B. H. Sleight, III.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 251-268, 1979. 1 Fig, 6 Tab, 29 Ref.

Descriptors: *Food chains, *Organic compounds, *Chemical wastes, Path of pollutants, *DDT, *Cadmium, *Endrin, Pesticide residues, Water chemistry, Absorption, Chemical analysis, Chemical properties, Aquatic environment, *Biomagnification, *Bioaccumulation, *Tissue analysis, *Leptophos, *Kepone, *Bioconcentration, *Depuration.

The relative importance of dietary and aqueous exposure of bluegill sunfish to di(2-ethylhexyl) phthalate, 1,2,4-trichlorobenzene, and leptophos are quantitatively evaluated at steady state. The results of this investigation indicate that the incremental steady-state body burden due to dietary exposure is statistically indistinguishable from that due to aqueous exposure. Critical analyses of similar studies with cadmium, endrin, and Kepone support the hypothesis that biomagnification of chemical residues within aquatic food chains is quantitatively insignificant when compared with the process of bioconcentrations of chemical residues directly from water. Dichlorodiphenyltrichloroethane (DDT) appears to be the only chemical of those evaluated with a potential for significant accumulation of residues through an aquatic food chain. Data on the biological persistence of chemicals in aquatic organisms, as measured by the rate of depuration from tissues, appear to offer a mechanism for identifying those few chemicals which may have potential for measurable accumulation through food chains. All of the data presented indicate that the process of biomagnification, as classically defined, probably does not occur within communities of aquatic organisms. (Deal-EIS)
W80-02115

EXPOSURE ASSESSMENT: A KEY ISSUE IN AQUATIC TOXICOLOGY,
Environmental Research Lab., Athens, GA.
W. M. Sanders, III.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 271-283, 1979. 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Bioassay, *Methodology, *Analytical techniques, Laboratory tests, Mathematical models, Chemical properties, Chemical analysis, Monitoring, Chemical degradation, Microbial degradation, Path of pollutants, Aquatic environment, Organic compounds, Pesticides.

Environmental exposure assessment is a new and emerging science, and, although some processes have not been adequately characterized, tests for the most significant ones (volatilization, hydrolysis, oxidation, etc.) are available. Both screening tests and detailed protocols are presently available for determining the process kinetics for selected chemicals exposed to differing environmental conditions. Preliminary exposure assessments can be made from the screening data if the following rate processes are estimated: microbial degradation, chemical transformation, photolysis, hydrolysis, ionization, and partitioning. Because these processes can act either synergistically or competitively, depending upon the chemical structure of the material and the conditions of the environment, great care must be taken to conduct the tests in sequential order. The greatest unrealized potential for exposure assessment lies in the use of mathematical modeling techniques. When environmental exposure models are coupled with environmental effects models, powerful tools for risk assessment emerge. Such sophisticated models need to be refined and verified, however, before risk analysis becomes accurate and cost effective. (Deal-EIS)
W80-02116

AN APPROACH TO THE TOXICOLOGICAL EVALUATION OF A COMPLEX INDUSTRIAL WASTEWATER,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
J. G. Pearson, J. P. Glennon, J. J. Barkley, and J. W. Highfill.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 284-301, 1979. 6 Tab, 14 Ref.

Descriptors: *Chemical wastes, *Explosives, *Methodology, Bioassay, Chemical properties, Water quality, Analytical techniques, Industrial wastes, Organic compounds, Chemical analysis, Daphnia, Minnows, Toxicity, *TNT, *Mutagens.

The U.S. Army is currently conducting research to develop the data base required to establish water quality criteria for wastewater discharged from 2,4,6-trinitrotoluene (TNT) production facilities. Because over 30 munitions-related compounds are

involved, a traditional compound-by-compound approach to the toxicological evaluation of this complex wastewater was considered both technically unacceptable and economically prohibitive. An alternate approach was developed that placed research emphasis on the toxicological evaluation of a representative wastewater mixture. The initial task, therefore, was to conduct a detailed wastewater chemical characterization study over a period of several months. Wastewater constituents were identified and quantified, and, through the use of statistical procedures, a mixture representative of the actual wastewater was defined. Only 22 of the compounds identified in the actual wastewater were detected consistently above the parts-per-billion detection limit. These were included in the mixture designated for detailed toxicological testing. To identify possible trace constituents with extraordinary toxicological properties, all the identified compounds received screening-type toxicological testing. We believe that this combined approach of a single compound and moisture testing provides both an economical and scientifically acceptable approach to the development of water quality criteria for complex industrial wastewaters that remain relatively constant over time. (Deal-EIS)
W80-02117

INTERPRETATION OF CHEMICAL WATER QUALITY DATA,
Colorado State Univ., Fort Collins.
G. F. Lee, and R. A. Jones.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials. STP 667, p 302-321, 1979. 15 Ref.

Descriptors: *Water quality, *Methodology, *Reliability, Water quality standards, Testing procedures, Analysis, Analytical techniques, Bioassay, Data collections, Estimating, Chemical properties, Mode of action, Water chemistry.

Meaningful interpretation of water quality data requires an evaluation of the reliability of the data. Particular attention must be given to evaluation of the applicability of the analytical methods used, sampling and sample handling procedures, and analytical quality control program. There are many problems with the use of the U. S. Environmental Protection Agency (EPA) water quality criteria as a basis for evaluating water quality. Meaningful interpretation of data requires consideration of the concentation-time of the exposure relationships that exist at a given location within a body of water where the concentration of a chemical is in excess of the U. S. EPA criterion. Also, consideration must be given to the amount of the contaminant which is available to affect water quality. This may require the use of bioassay procedures since, in general, chemical procedures provide a relatively poor estimate of the amount of available contaminant present in a water sample. In addition, consideration must be given to the physical and chemical characteristics of the water since they may markedly affect the significance of a chemical contaminant for water quality. (Deal-EIS)
W80-02118

EFFECTS OF CALCIUM AND SEDIMENT CONCENTRATIONS ON THE RELEASE OF METALS AND NUTRIENTS FROM DREDGE SPOIL DISPERSIONS,
Corps of Engineers, Detroit, MI. Detroit District.
F. L. Snitz, W. J. Weber, Jr., J. L. Barney, and J. C. Posner.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 322-341, 1979. 8 Fig, 4 Tab, 25 Ref.

Descriptors: *Dredging, *Sediments, *Metals, *Nutrients, Calcium, Water chemistry, Great lakes, Suspended solids, Magnesium, Cadmium, Copper, Lead, Zinc, Iron, Manganese, Chromium, Phosphates, Nitrogen, Channel improvement, *Arsenic.

Sediment from the lower Cuyahoga River (5.8 river km from the mouth at Lake Erie) was dispersed in reactors containing simulated lake water constituted to have pH, dissolved oxygen (DO), alkalinity, and hardness values typical of Great Lakes Waters. The parameters of pH and DO were maintained constant during the course of the experiments, while calcium and sediment dispersion concentrations were systematically varied. The calcium ranged from 5 to 120 mg/litre and the sediment from 0.5 to 50 g(dry)/litre. The materials investigated for release from the sediment dispersions included magnesium, cadmium, copper, lead, zinc, iron, chromium, arsenic, total dissolved phosphate as PO4, and total Kjeldahl nitrogen. In general, the extent of release was inversely related to the calcium and sediment concentrations. Significantly, the unit release of metals and nutrients in oxygenated waters increased two to five-fold with each order-of-magnitude decrease in sediment dispersion concentration. The methods of the research bear upon the development of procedures for evaluating the potential impact of dredging operations on water quality. The results of this investigation show that the amounts of dredge spoil constituents released into solution can be comparable in magnitude to those of dissolved mineral species in rivers and outfalls. (Deal-EIS)
W80-02119

TRANSPORT AND TRANSFORMATIONS OF ANTHRACENE IN NATURAL WATERS,
Oak Ridge National Lab., TN.
G. R. Southworth.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials STP 667, p 359-380, 1979. 5 Fig, 5 Tab, 15 Ref.

Descriptors: *Path of pollutants, *Microbial degradation, *Aquatic environment, Aromatic compounds, Fuels, Chemical properties, Chemical analysis, Biodegradation, Chemical degradation, Sediments, Daphnia, Minnows, Zooplankton, *Anthracene, *Bioaccumulation, *Tissue analysis.

Polycyclic aromatic hydrocarbons (PAH) commonly occur in wastes from pyrolysis of biogenic fuels. Because some PAH are known carcinogens, an understanding ot their environmental behavior and persistence is critical to determining their potential hazard to man. While many processes may remove or transform PAH in aquatic ecosystems, several may be particularly important in determining the fate of PAH in most systems. Laboratory measurement of the rates of various processes under controlled conditions are identifying those critical parameters of environmental transport where more detailed research is necessary. Anthracene was selected as a representative PAH because of its intermediate molecular weight and its lack of carinogenicity. The rate of photolysis, hydrolysis, volatilization, and microbial degradation of anthracene were measured under different environmental conditions, using fluorimetric and radiotracer techniques. The equilibrium constants for processes such as sorption and bioaccumulation were also determined. The results of the study indicated that photolysis and microbial degradation within the water column are likely to be the dominant pathways of anthracene removal from aquatic systems. More research is needed to ascertain the degree to which the microbial degradation rates observed in this study are representative of other PAH-contaminated systems. (Deal-EIS)
W80-02121

THE EFFECT OF PLANTS AND ANIMALS ON THE CHEMISTRY OF ESTUARINE SEDIMENTS,
Cape Town Univ. (South Africa). Dept. of Zoology.
J. H. Day.
In: Biogeochemistry of Estuarine Sediments, Proceedings of a Unesco/SCOR Workshop held in Melreux, Belgium, 29 November to 3 December 1976, p 216-221, 1978. 8 Ref. Unesco, Paris, France.

Descriptors: *Geochemistry, *Benthic fauna, *Benthic flora, *Bottom sediments, Estuarine environment, Biochemistry, Chemical analysis, Nutrients, Aquatic plants, Aquatic algae, Oxygen, Trace elements, Food chains, Detritus, Burrows, Decomposing organic matter, Diatoms, Crustaceans, Zooplankton, *Bioturbation, *Bioconcentration, *Polychaetes.

In this paper the biogeochemistry of estuarine sediments are studied for the effects of higher plants and animals. These organisms are a source of organic detritus, including the substrates upon which the bacteria depend. Complex organic molecules are oxidized or reduced and simple substances are released including plant nutrients - which are taken up by the roots of vascular plants or diffuse into the water column where they can be absorbed by algae. There are many other changes as well. Both plant roots and burrowing animals carry down oxygen into the sediments and simple organic compounds diffuse into the interstitial waters. Trace metals are absorbed and usually concentrated by living organisms, including migratory fish and birds which transport them out of the estuary. Possibly the most important changes are due to bioturbation by burrowing animals which bring up material from the reduced subsurface layers to be oxidised on the surface and thus replenish continuously the intersitial waters. (Deal-EIS)
W80-02122

CRITICAL FACTORS IN THE TRANSPORT OF LIVING FRESHWATER FISH--I. GENERAL CONSIDERATIONS AND ATMOSPHERIC GASES,
Ministry of Agriculture, Fisheries and Food, London (Endland). Salmon and Freshwater Fisheries Lab.
A. L. Taylor, and D. J. Solomon.
Fisheries Management, Vol 10, No 2, p 27-32, 1979. 3 Fig, 15 Ref.

Descriptors: *Fish management, *Fish physiology, *Fish behavior, Fish diseases, Salinity, Water temperature, Dissolved oxygen, Toxicity, Oxygen requirements, Mortality, Fish stocking, Water chemistry, Carbon dioxide, *Fish transport.

Factors which can influence the sucessful transport of live freshwater fish are discussed, including condition of fish, container design, density, temperature, dissolved oxygen and carbon dioxide, and the use of saline solutions. Capture and transport methods should be aimed at minimizing integument damage. Fish crowding should be minimized, as rapid reaeration becomes critical, and excretory products may build up to toxic levels. Methods to regulate oxygen and carbon dioxide levels are presented. The use of dilute saline solutions to reduce loss of body water and salts and prevent fungal infections is also reviewed. (See also W80-02126) (Deal-EIS)
W80-02125

CRITICAL FACTORS IN THE TRANSPORT OF LIVE FRESHWATER FISH--II. STATE OF FEEDING AND AMMONIA EXCRETION,
Ministry of Agriculture, Fisheries and Food, London (England). Salmon and Freshwater Fisheries Lab.
D. J. Solomon, and A. L. Taylor.
Fisheries Management, Vol 10, No 2, p 81-85, 1979. 4 Fig, 6 Ref.

Descriptors: *Fish physiology, *Oxygen requirements, *Ammonia, *Agriculture, Perches, Fish management, Mortality, Toxicity, Fish diets, Feeding rates, Shrimp, Animal metabolism, *Fish transport.

Two serious problems in the transport of live freshwater fish are oxygen depletion and ammonia toxicity. Studies were performed on perch (Perca fluviatilis) to quantify these two parameters. It was noted that following feeding there is a marked increase in oxygen consumption probably due to the metabolic processes of growth and tissue replacement. It was not possible to determine the relationship of meal size to this change. In studies of ammonia excretion it was found that post-feeding excretion rates varied directly with meal size. In reference to live transport it was recommended that a period of starvation precede moving in order to minimize risks. (See also W80-02125) (Deal-EIS)
W80-02126

REINVESTIGATION OF THE TOXINS FROM THE BLUE-GREEN ALGA, APHANIZOMENON FLOS-AQUAE, BY A HIGH PERFORMANCE CHROMATOGRAPHIC METHOD,
Rhode Island Univ., Kingston. Dept. of Pharmacognosy.
M. Alam, Y. Shimizu, M. Ikawa, and J. Sasner, Jr.
Journal of Environmental Science Health, Vol A13, No 7, p 493-499, 1978. 2 Fig, 9 Ref. OWRT A-047-NH(2), 14-34-0001-7062.

Descriptors: *Toxins, *Algal toxins, *Chromatography, *Cyanophyta, *Shellfish, Aquatic life, *Saxitoxin, *Toxin detection, *Blue-Green algal glooms, *Red tides, New Hampshire, Lakes.

Toxic red tides due to blue-green alga Aphanizomenon flos-aquae are becoming common occurrences in the lakes of New Hampshire. The toxins from Aphanizomenon flos-aquae were purified by a high performance chromatographic method. One of the toxins was identified as saxitoxin; the other three gave reactions indicating their structural similarity to toxins isolated from Gonyaulax tamarensis.
W80-02159

WATER QUALITY ASSESSMENT OF THE TRIBUTARIES TO THE FOX CHAIN OF LAKES,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Transactions of the Illinois State Academy of Sciences, Vol 71, No 3, p 260-272, November 1978. 1 Fig, 11 Tab, 7 Ref.

Descriptors: *Water quality, *Tributaries, *Streams, *Sampling, *Illinois, Lakes, Rivers, Pollutants, Temperature, Water temperature, Dissolved oxygen, Turbidity, Hydrogen ion concentration, Alkalinity, Hardness(Water), Nitrogen, Silica, Iron, Chlorides, Sulfates, Phosphorus, Water pollution sources, Path of pollutants, Pollutant identification, *Fox Chain of Lakes(IL).

An assessment of the water quality characteristics of the Fox River and four other tributaries to the Fox Chain of Lakes, based on a year long weekly sampling schedule, was presented. The stream waters are typical of the midwestern region, high in alkalinity and hardness. The dissolved oxygen concentrations were below 5 mg/l in the major tributaries. Nippersink Creek showed the highest rate of nitrate transported, 4.54 kg/ha/yr, followed by 3.92 kg/ha/yr for the Fox River at Route 173. The unit nitrate loads transported by all of these streams are considerably less than the average nitrate contribution of 23.53 kg/ha/yr observed for the Kaskaskia River upstream of Shelbyville. The phosphorus concentrations in the Fox River, Sequoit Creek, and Squaw Creek exceeded the Illinois Pollution Control Board's recommended limit all of the time. The total phosphorus transported by the tributaries to the Fox Chain of Lakes appears to be several orders of magnitude higher when compared with the total phosphorus transported by rivers in central Illinois. (Sims-ISWS)
W80-02168

NUTRIENT BUDGET AND ITS CRITICAL EVALUATION FOR THE FOX CHAIN OF LAKES,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 5B.
W80-02169

A SIMPLIFIED STATISTICAL SEQUENCE APPLIED TO ROUTINE WATER QUALITY ANALYSIS: A CASE HISTORY,
International Minerals and Chemical Corp., Detroit, MI.
For primary bibliographic entry see Field 5B.
W80-02172

PREDICTING LEVEL OF DISSOLVED REACTIVE PHOSPHATE IN THE LAFAYETTE RIVER, VIRGINIA, FROM INFORMATION ON TIDE, WIND, TEMPERATURE, AND SEWAGE DISCHARGE,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
For primary bibliographic entry see Field 5B.
W80-02178

OPTICAL MEASUREMENTS OF CRUDE OIL SAMPLES UNDER SIMULATED CONDITIONS,
National Environmental Satellite Service, Washington, DC.
W. A. Hovis, and J. S. Knoll.
NOAA Technical Memorandum NESS 105, October 1979. 16 p, 15 Fig, 6 Ref.

Descriptors: *Crude oil, *Oil pollution, *Water pollution, Spectroscopy, Remote sensing, Pollutant identification, Optical measurement, Weathering.

Spectrographic measurements of the solar reflectance from 0.2 to 2.4 micro meter and radiometric equivalent blackbody temperature measurements from 10.5 to 12.5 micro meter were made on 10 different types of crude oil under simulated aging conditions of sun, wind, and salt water wave action at the USEPA OHMSETT site in Leonardo, N.J. Four days of exposure produced little change in the reflectance from 0.2 to 2.4 micro meter, but oil-water temperature differences of up to 18C were recorded in the 10.5 to 12.5 micro meter region. Large changes in viscosity were also measured. (NOAA)
W80-02210

MECHANISMS OF COPPER TOLERANCE IN THE MARINE FOULING ALGA ECTOCARPUS SILICULOSUS- EVIDENCE FOR AN EXCLUSION MECHANISM,
Manchester Polytechnic Lancashire (England). Dept. of Biological Sciences.
A. Hall, A. H. Fielding, and M. Butler.
Marine Biology, Vol 54, p 195-199, 5 Tab, 18 Ref.

Descriptors: *Copper, *Antifouling materials, *Marine algae, Resistance, Toxicity, Metabolism, Membrane processes, Biological membranes, Growth rates, Fouling, Algicides, Muisance algae, Plant physiology, *Ectocarpus.

Copper-tolerant strains of the marine fouling alga Ectocarpus siliculosus, have been recorded. The mechanism of tolerance which may operate in a copper-tolerant strain were investigated by comparing the growth characteristics, copper content and extracellular organic production of tolerant and non-tolerant strains. Growth was measured by a wet-weight method. The copper content of dry-ashed cells was measured spectrophotometrically using tetraethyl-thiuram disulphide. Evidence suggests that an exclusion mechanism is operating in the tolerant strain under investigation. The extracellular material, the cell wall or an associated organisms make little or no contribution to this exclusion. Membrane and intracellular changes are believed to account for the tolerance in this train of E. siliculosus. (Deal-EIS)
W80-02213

CHLORINATED PARAFFINS-AN ENVIRONMENTAL HAZARD,
National Swedish Environment Protection Board, Studsvik. Brackish Water Toxicology Lab.
O. Svanberg, and E. Linden.
Ambio, Vol 8, No 5, p 206-209, 1979. 2 Fig, 18 Ref.

Descriptors: *Organic compounds, *Toxicity, *Hazards, Path of pollutants, Chemical wastes, Chemical properties, Chemical analysis, Analytical techniques, Chemical degradation, Absorption, Fish physiology, Persistence, Rainbow trout, Fish diets, Mode of action, Biodegradation, *Chlorinated paraffins, *Paraffins, *Tissue analysis, *Bioaccumulation.

Chlorinated paraffins form a large group of products, used mainly as secondary plasticizers, oil additives and flame retardants. World production amounts to about 230,000 metric tons per year. Lack of specific sensitive analytical methods has made it impossible to explore the spread of these persistent chemicals in the environment. The extent of their degradation and the degradation products formed under natural conditions are not known. Uptake from water and accumulation in fish is dependent on the chemical structure of the product. Their acute toxicity to mammals is considered low but very little is known concerning their chronic toxicity. Symptoms of toxic effects in exposed fish, however, have been observed. (Deal-EIS)
W80-02214

MERCURY IN WATER AND FISH FROM THE SAO VINCENTE ESTUARY NEAR SANTOS, BRAZIL,
Instituto de Pesca, Santos (Brazil). Coordenadoria de Pesquisa de Recursos Naturais,
J. R. Ferreira, H. Bergman Filho, J. F. Krug, N. A. Menezes, and P. E. Hansen.
Ambio, Vol 8, No 5, p 210-213, 1979. 3 Fig, 2 Tab, 28 Ref.

Descriptors: *Mercury, *Chemical wastes, *Water quality standards, Path of pollutants, Heavy metals, Estuarine environment, Water chemistry, Chemical analysis, Industrial wastes, Absorption, Fish physiology, Radiochemical analysis, Water pollution sources, Trophic level, Mullets, *Tissue analysis, *Bioaccumulation.

Total mercury was determined in water and edible fish from the Sao Vicente estuary using substoichiometric radioisotope dilution analysis. The water was found to conain 0.01-10 microg Hg/l with average values of 2.14, 1.80, and 1.66 microg/l at three sampling sites situated 30-35 km downstream from a large industrial region. These figures indicate gross mercury pollution. The fish were found to contain from 3 to 860 microg hg/kg in muscle tissue; the large majority were well below tolerance limits for human consumption (500 ug/kg). A future increase in the mercury content of the fish is indicated. (Deal-EIS)
W80-02215

RESPONSES TO SALINITY IN LARVAE FROM THREE LOCAL POPULATIONS OF THE FRESHWATER SHRIMP, MACROBRACHIUM NIPPONENSE,
Tokyo Univ. of Fisheries (Japan). Fisheries Resources Research Lab.
Y. Ogasawara, S. Koshio, and Y. Taki.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 8, p 937-943, 1979. 1979. 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Salinity, *Adaptation, *Shrimp, Growth stages, Growth rates, Salt tolerance, Habitats, Larval growth stage, Animal populations, Animal physiology, Animal metabolism, Toxicity, Mortality, Lakes, *Zoeae.

Responses to variations in salinity were examined in larvae of the freshwater plaemonid shrimp Macrobrachium nipponense derived from females collected in Lake Kasumigaura, Lake Biwa, and the Shimanto River. Zoeas from kasumigaura females adjusted most successfully to seawater dilutions of 30-50% while those from Shimanto females to 40-70% sea water. Zoeas from Biwa females showed rather inconsistent survival patterns, but their response to salinity was on the whole not very different from that of Kasumigaura zoeas. The duration of the free-swimming larval stage was much linger in Shimanto zoeas than in Kasumigaura and Biwa zoeas. In each local sample the duration tended to be shorter in optimum salinity levels and longer in unfavorable salinities. The carapace length of 1st-stage zoeas was 0.30-0.38 mm for Kasumigaura zoeas and 0.23-0.25 mm for Shimanto zoeas. These results suggest that the duration of the free-swimming larval stage, as well as the number of zoea stages, decreases as the shrimp undergoes adaptation to fresh water, and that M. nipponese inhabiting Lakes Kasumigaura and Biwa is in a more advanced position than that occurring in the Shimanto River with regard to the degree of adaptation to fresh water. (Deal-EIS)
W80-02216

REQUIREMENT OF CARP FOR DIETARY ZINC (IN JAPANESE),
Tokyo Univ. of Fisheries (Japan). Lab. of Fish Nutrition.
C. Ogino, and G-Y. Yang.
Bulletin of Japanese Society of Scientific Fisheries, Vol 45, No 8, p 967-969, 1979. 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Nutrient requirements, *Zinc, *Carp, Trace elements, Heavy metals, Fish physiology, Animal metabolism, Fish diets, Fish diseases, Water chemistry, Growth rates, Mortality, Toxicity, *Iron, *Copper, Chemical analysis, *Tissue analysis, *Bioaccumulation.

Carp weighing 1.9 g and 1.5 g on the average were fed purified diets containing different amounts of zinc for 12 and 16 weeks, respectively. The rearing water contained zinc at a level of 10 microg per l. Dietary zinc levels were found to affect not only the appetite, growth rate, and mortality of the carp, but also the levels of zinc, iron, and copper in the tissues. The fish fed the diet containing 1 ppm zinc suffered from erosion of the skin and the fins. The requirement of carp for dietary zinc was proved to be 15 to 30 ppm of the dry diet under the present experimental conditions. (Deal-EIS)
W80-02217

ISOLATION AND IDENTIFICATION OF A CONJUGATED-PCP EXCRETED IN THE URINE OF GOLDFISH,
Kyushu Univ., Fukuoka (Japan). Lab. of Fisheries and Chemistry.
K. Kobayashi, and N. Nakamura.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 8, p 1001-1003, 1979. 4 Fig, 9 Ref.

Descriptors: *Pollutant identification, *Fish physiology, *Path of pollutants, Animal metabolism, Organic compounds, Chemical analysis, Chromatography, Chemical properties, Biochemistry, Sulfates, Potassium, *Goldfish, *Carassius, *Pentachlorophenol.

The renal excretion of PCP absorbed by goldfish, Carassius auratus, exposed to PCP and the isolation and identification of a PCP-conjugate found in the urine have been studied. Approximately 90% of the PCP excreted in the urine was found in a conjugate-form. The conjugate was isolated by treating the urine with an activated charcoal column, followed by elution with an acetone-ammonia mixture, and finally by passing the concentrated eluate through a Sephadex G-10 column. The isolated conjugate was identified as pentachlorophenylsulfate by the elution pattern on the Sephadex column, by thin-layer chromatography, and finally by determination of the molar ratio of PCP to SO4. No other conjugates, such as the glucuronide, were detected in the urine. (Deal-EIS)
W80-02218

AN ECOLOGICAL AND ENVIRONMENTAL SURVEY OF THE HUMIC MAN-MADE LAKES IN FINLAND,
Helsinki, Univ. (Finland). Dept. of Environmental Conservation.
H. Vogt.
Aqua Fennica, Vol 8, p 12-24, 1978. 9 Fig, 3 Tab, 16 Ref.

Descriptors: *Lakes, *Reservoirs, Lake sediments, *Artificial lakes, Peat, Fish population, Fish management, Finland, Lake stages, Lake ecosystems, Surface areas, Water quality, Acidic water, Humus, Humus lakes, *Primary productivity, Zooplankton, Bottom fauna, Environmental effects.

In western and northern Finland there are 18 polyhumic man-made lakes that are strongly regulated. This survey deals with the ecological properties of these highly peculiar aquatic ecosystems. Three different phases can be distinguished in the succession development of man-made lakes: beginning, erosion and stabilization. It will take tens, even hundreds of years before these reservoirs reach the stage of stabilization. The study also deals with the effects of these man-made lakes on nature and on human environment as well as with the possibilities of restoring the lakes. To restore the lakes to productivity special attention should be paid to the management and care of the scenery and the fish populations as well as to improving the quality of the water in the reservoirs. (Katz-EIS)
W80-02219

HEAVY METALS IN THE SEA-SKATER HALOBATES ROBUSTUS FROM THE GALAPAGOS ISLANDS: CONCENTRATIONS IN NATURE AND UPTAKE EXPERIMENTS, WITH SPECIAL REFERENCE TO CADMIUM,
Scripps Institution of Oceanography, La Jolla, CA.
L. Cheng, P. J. Franco, and M. Schulz-Baldes.
Marine Biology, Vol 54, p 201-206, 1979. 1 Fig, 2 Tab, 22 Ref.

Descriptors: *Cadmium, *Absorption, *Insects, Heavy metals, *Zinc, *Copper, *Lead, *Chromium, Growth stages, Zooplankton, Path of pollutants, Chemical analysis, Animal metabolism, *Bioaccumulation, *Tissue analysis, *Halobates.

Samples of Halobates robustus from the Galapagos Islands were analysed by optical emission spectrometry. The levels (in microg g-1 dry weight) of Zn (134), Cu (155), Pb (<1), Cd (7), and Cr (3) were not significantly different among insects of different sexes or developmental stages. The low natural levels of Cd in H. robustus from the relatively unpolluted envirnoment of the Galapagos Islands are compared to the high concentrations of Cd in Halobates spp. from relatively polluted regions. Since the measured levels of Cd in their natural zooplankton food rarely exceed 10 microg./g, and very little of the Cd is found in the soft tissues, the high Cd concentrations (100 to 200 microg./g) in some sea-skater species have evidently been derived by drinking from the surface micro-layer of the seawater. (Deal-EIS).
W80-02221

SOME STUDIES ON THE HEPATIC MICROSOMAL ENZYME ACTIVITIES AND STEROID HORMONE LEVELS IN CARP, CYPRINUS CARPIO EXPOSED FOR SIX MONTHS,
London Univ. (England).
K. Sivarajah, C. S. Franklin, and W. P. Williams.
Journal of Fish Biology, Vol 15, p 249-253, 1979. 1 Fig, 3 Tab, 10 Ref.

Descriptors: *Enzymes, *Toxicity, *Polychlorinated biphenyls, Fish physiology, Animal metabolism, Biochemistry, Proteins, Water chemistry, Organic compounds, Gas chromatography, Pollutant identification, Mode of action, *Blood chemistry, *Tissue analysis, *Hormones.

A short-term study from October 1975 to April 1976 was carried out by keeping 10 carp in two separate cages (five in each) at each of the three sites, namely, Wraysbury Reservoir, Ryemeads Sewage Lagoon and Deephams Sewage Lagoon (Fish unit). Fish were not artificially fed. Blood samples were collected at monthly intervals. Activities of the following hepatic microsomal enzymes, aminopyrine demethylase, p-nitro-reductase, UDP-glucuronyl transferase and 1-leucyl-B-naphthylamide splitting enzymes were measured; cytochrome P450 and microsomal protein contents were also estimated. The levels of androgens, oestrogens and corticoid hormones were measured in the circulating blood at monthly intervals. Results indicated that there was (1) no significant increase in the activities of all the enzymes measured except for an increase in cytochrome P450 in the fish kept at Deephams Sewage treatment works, (2) no significant increase in microsomal protein content at the three sites and (3) no significant changes in the levels of plasma androgens, and corticoids of the circulating blood. (Deal) (EIS).
W80-02225

EFFECTS OF TEMPERATURE AND STOCKING DENSITY ON FOOD CONSUMPTION AND GROWTH OF GRASS CARP CTENOPHARYNGODON IDELLA, VAL.,
Arkansas Univ., Fayetteville. Dept. of Zoology.
R. V. Kilambi, and W. R. Robison.
Journal of Fish Biology, Vol 15, p 337-342, 1979. 6 Tab, 21 Ref.

Descriptors: *Water temperature, *Growth rates, *Carp, Fish physiology, Fish management, Feeding rates, Fish populations, Fish farming, Productivity, Length, Size, Weight, Energy conversion, *Population density.

Grass carp were raised in 227 liter indoor tanks at 12.8, 18.3, 23.9 and 29.4C temperatures, each experimental condition received five fish. Five grass carp were also raised in a 1135 l tank maintained at 29.4C representing low stocking density (29.4 C-L). Food consumption, food conversion, and growth of carp were not different among the 18.3, 23.9, and 29.4C experimental conditions with identical stocking density. The least growth and food consumption were noted for the fish at the 12.8C temperature. The fish at the low stocking density had the best growth and maximum food consumption. (Deal-EIS).
W80-02226

RELATIONSHIP OF ENVIRONMENTAL PCO2 TO SELECTED BLOOD PARAMETERS OF ONCORHYNCHUS KISUTCH (WALBAUM),
Rhode Island Univ., Kingston. Dept. of Animal Science.
J. K. Bubien, and T. L. Meade.
Journal of Fish Biology, Vol 15, p 343-347, 1979. 1 Fig, 2 Tab, 12 Ref.

Descriptors: *Carbon dioxide, *Water chemistry, *Toxicity, *Fish physiology, Animal metabolism, Sockeye salmon, Bicarbonates, Chlorides, Hydrogen ion concentration, Chemical analysis, Gases, *Tissue analysis, *Blood chemistry.

Blood samples from sub-adult coho salmon were correlated with environmental conditions. Carbon dioxide tensions, pH and bicarbonate levels were determined in the blood for fish acclimated to environmental pC02 levels of 2.49 and 2.74 mmHg. Fish were removed from the high pC02 environment and placed in one with a low pC02. Their blood pH and pC02 were monitored during the course of acclimation. After 27 days of acclimation to a low pC02 environment, a group of fish was sampled and compared to a group of fish acclimated to a high pC02 environment. It was found that pC02 in the environment affects the rate of diffusion of carbon dioxide from the blood to the water. Under the environmental conditions prescribed in these experiments no significant change in bicarbonate was noticed. It is postulated that a bicarbonate chloride exchange is not a major pathway for the removal of carbon dioxide from the blood of 0. kisutch. (Deal-EIS).
W80-02228

PHYSICAL AND CHEMICAL ASPECTS OF THE DISTRIBUTION OF POLYCHLORINATED BIPHENYLS IN THE AQUATIC ENVIRONMENT,
URS Co., Seattle, Wa.
S. P. Pavlou, and R. N. Dexter.
In: Aquatic Toxicology, American Society for Testing & Materials, STP667, L. L. Marking & R. A. Kimerle, Eds., p 195-211, 1979. 6 Fig, 6 Tab, 27 Ref.

Descriptors: *Polychlorinated biphenyls, *Aroclors, Water quality, *Chemical analysis, Sediments, *Zooplankton, Puget Sound, Estuaries, Path of pollution, Water pollution, Chemical properties, Reactions(Chemical), Chemical distribution, Methodology, Annual changes, Suspended phases.

The distribution of polychlorinated biphenyl (PCB) compounds in Puget Sound is discussed in terms of the physical and chemical processes that influence their flow throughout the estuary. These data were used to examine the accumulation of PCBs in suspended phases and in lower trophic level biota. At the low PCB levels detected in this region, the data suggest that accumulation is predominantly governed by an equilibrium-partitioning mechanism. Support for the applicability of partitioning constants is presented, together with a discussion of their utility in describing the general distribution of PCBs in the aquatic environment. (KATZ-EIS).

W80-02229

STUDY OF THE EFFECTS OF MINING AND MILLING OPERATIONS ON HIGH MOUNTAIN STREAMS,
Colorado Dept. of Natural Resources, Fort Collins. Div. of Wildlife.
J. P. Goettl, Jr., and P. H. Davies.
In: Water Pollution Studies. Job Progress Report, Federal Aid Project F-33-R-13, p 1-5, 1978. 2 Tab.

Descriptors: *Metals, *Zinc, *Cadmium, *Colorado, Williams Fork River, *Mine drainage, Mine wastes, Mineral industry, Water pollution effects, Water quality, Mining, Rio Grande River, High mountain streams, Brook trout, Freshwater fish.

Heavy metal concentrations in the Williams Fork River below the Henderson Project do not appear to have been altered by operation of the mill. Cadmium continues to appear as a contaminant above the mine and mill site. The Rio Grande River below the mining district of Creede had approximately the same level of zinc (75 microg/liter) as observed during high water periods the past 2 years. (Katz-EIS).
W80-02250

STUDY OF THE EFFECTS OF METALIC IONS ON FISH AND AQUATIC ORGANISMS,
Colorado Dept. of Natural Resources, Fort Collins. Div. of Wildlife.
J. P. Goettl, Jr., and P. H. Davies.
In: Water Pollution Studies. Job Progress Report, Federal Aid Project, F-33-R-13, p 6-40, 1978. 13 Tab.

Descriptors: *Zinc, *Copper, *Lead, *Cadmium, *Silver, *Manganese, *Selenium, Metals, Toxicity, Rainbow trout, Freshwater fish, Toxicity, Mortality standards, Water quality, Colorado, Bioassay, Laboratory tests.

On the basis of laboratory experiments it was determined that only poor fisheries will be found in water with more than 400 mg/l suspended solids. Fish fed 10 micrograms of selenium/gram food had 21% mortality. The liver is the most suitable organ for detecting prior long term exposure to cadmium. Warm water species may be as sensitive to zinc as rainbow trout. Fathead minnows, speckled dace and mottled sculpins are as sensitive to silver as rainbow trout. 1.0 mg/liter for manganese is recommended as a standard for Colorado. There is a lack of synergistic or additive effects for solutions of zinc, copper, lead, cadmium and silver. (Katz-EIS).
W80-02251

MERCURY IN SOUTHERN NEW ENGLAND COASTAL RAINS,
Connecticut Univ., Groton. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W80-02326

INFLUENCE OF WELL WATER QUALITY VARIABILITY ON SAMPLING DECISIONS AND MONITORING,
Science and Education Administration, Fresno, CA. Water Management Research.
For primary bibliographic entry see Field 5B.
W80-02356

THE RELATIONSHIP BETWEEN VERTEBRAL NUMBER AND WATER TEMPERATURE IN COD,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
K. Brander.
Journal du Conseil, Inst. Explor. Mer. Vol 38, No 3, p 286-292, 1978. 3 Fig, 2 Tab, 1 App, 15 Ref.

Descriptors: *Water temperature, *Toxicity, *Animal growth, Marine fish, Growth stages, Fish populations, Spawning, Age, Atlantic Ocean, Mode of action, *Cod, *Tissue analysis, *Teratogens, *Vertebrae.

An inverse relationship between water temperature during early development and mean vertebral number (VS, includes urostyle) is established for cod populations throughout the North Atlantic, but the extent to which differences in VS are inherited is unknown. The VS of different year classes of cod from the North Sea shows some dependence on water temperature and the year class should therefore be taken into account, where possible, when seeking evidence of separation between stocks. Values of VS for populations around the British Isles are plotted on the temperature-VS relationship. Two areas for which the vertebral numbers seem anomalous are the English Channel and the northeast Irish Sea and these anomalies are discussed. (Deal-EIS)
W80-02368

THE INFLUENCE OF TEMPERATURE CHANGE ON NUMBER OF ANAL FIN RAYS DEVELOPING IN FUNDULUS MAJALIS (WALBAUM),
North Carolina Univ., Morehead City. Inst. of Marine Sciences.
W. E. Fahy.
Journal du Conseil Int. Explor. Mer, Vol 38, No 3, p 280-285, 1978. 1 Fig, 3 Tab, 20 Ref.

Descriptors: *Water temperature, *Toxicity, *Animal growth, Growth rates, Growth stages, Killfishes, Embryonic growth stage, Thermal stress, Habitats, Mortality, Hatching, *Teratogens, *Tissue analysis, *Vertebrae.

In each of two experiments embryos of this cyprinodont fish were reared continuously in four fluctuating temperature regimes, 13-17, 18-22, 23-27, and 28-32C to determine response of presumptive anal fin-ray tissue to temperature change. Because of excessive mortality among embryos in the 13-17C temperature regime, only one transfer lot from this regime could be used. In both experiments a positive linear relationship was indicated between mean anal fin-ray count and temperature, more anal rays developed on the average with increasing temperatures. In one experiment the transfer of embryos from one of the cooler regimes to the warmest at a three-to-six-somite stage of development produced a mean anal fin-ray count similar to that of embryos reared continuously in the warmest regime, but significantly different from the mean of those reared continuously in the original cool regime. The transfer of embryos from one of the cooler regimes to the warmest at a nine-to-twelve-somite stage produced a mean anal fin-ray count similar to that of embryos reared continuously in the cooler regime, but significantly different from the mean of those reared continuously in the warmest regime. In regard to morphological time of fixation of anal fin-ray tissue in this species temperature can influence the number of anal fin rays at the three-to-six-somite stage of development; although the nine-to-twelve-somite stage showed no response to temperature influence, later stages may be sensitive. (Deal-EIS)
W80-02369

GOBIUS NIGER AS INDICATOR OF HGTOT MEAN CONCENTRATION IN THE MARINE ENVIRONMENT,
Parco Marino di Miramare, Trieste (Italy).
M. Bussani, and M. Princi.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkee, p 671-672, 1979. 1 Fig, 7 Ref.

Descriptors: *Mercury, *Bioindicators, *Water chemistry, Heavy metals, Aquatic environment, Chemical analysis, Crustaceans, Gastropods, Mollusks, Insects, Phaeophyta, Rhodophyta, Chlorophyta, *Gobius, *Tissue analysis, *Polychaetes.

156 measurements of total Hg on 86 marine organisms, both animal and plant, were performed during the years 1975 to 1977 in the Gulf of Trieste. A graphic solution of data revealed that the mean concentration of total Hg in 35 specimens of Gobius niger is closely correlated with that of all other organisms examined. It might therefore be advisable to chose Gobius niger as indicator of mercury contamination of the marine environment, also in view of its wide geographical distribution. (Deal-EIS)
W80-02372

UTILIZATION OF CONCENTRATING ORGANISMS (MYTILUS GALLOPROVINCIALIS LMK) FOR THE SURVEY AND CONTROL OF MARINE POLLUTION,
Trieste Univ. (Italy). Inst. of Hygiene.
L. Majori, G. Nedoclan, G. B. Mononutti, and F. Daris.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L' Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkee, p 599-604, 1979. 3 Fig, 28 Ref.

Descriptors: *Mussels, *Bioindicators, *Heavy metals, Mercury, Lead, Water chemistry, Chemical analysis, Amalutical techniques, Water quality, Monitoring, Research equipment, Methodology, *Mytilus, *Tissue analysis, *Bioaccumulation.

The feasibility of using the mussel (Mytilus galloprovincialis) as a monitoring organism for low level marine pollution is investigated. Mytilus species are ubiquitous organisms, making them a desirable indicator. Several experiments were summarized in which it was found that Mytilus accumulated metals from water proportional to the water concentration. When transfered to relatively unpolluted waters Mytilus depurated metals from its tissues. It was concluded that Mytilus is an acceptable organism for monitoring marine metal pollution. (Deal-EIS)
W80-02374

SHORT- AND LONG-TERM EFFECTS OF SOME POLLUTANTS ON BENTHIC COPEPODS OF GENUS TISBE (COPEPODA, HARPACTICOIDA),
Consiglio Nazionale delle Richerche, Venice (Italy). Inst. of Marine Biology.
L. Dalla Venezia.
In: IVes journees d'etudes sur les pollutions marine en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkee, p 439-443, 1979. 4 Fig, 1 Tab, 8 Ref.

Descriptors: *Oil, *Linear alkylate sulfonates, *Toxicity, *Copepods, Salinity, Detergents, Mortality, Growth stages, Lethal limit, Larval growth stage, Organic compounds, Biological communities, Chemical properties, *Dispersants, *Corexit.

Using copepods of the genus Tisbe, a series of experiments were conducted on the effects of an oil-oil dispersant-seawater mixture, a domestic detergent containing LAS, and LAS interactions with low salinity. In the oil-dispersant experiment, concetrations greater than 5 mg/l increased mortality above that of controls. As for the LAS experiments, a marked variability in sensitivity was noted between three different Tisbe species. It was concluded that low-level LAS pollution would eliminate the least resistant species. Finally, it was determined that lower salinities enhance the toxic effects of LAS. (Deal-EIS)
W80-02380

CHLORIDE INHIBITION OF NITRITE-INDUCED METHEMOGLOBINEMIA IN CHANNEL CATFISH (ICTALURUS PUNCTATUS),
Memphis State Univ., Ecological Research Center.
J. R. Tomasso, B. A. Simco, and K. B. Davis.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 1141-1144, 1979. 1 Fig, 1 Tab, 21 Ref.

Descriptors: *Fish physiology, *Toxicity, *Nitrite, Channel catfish, chlorides, Inhibition, Water chemistry, Mode of action, Chemical properties, Bicarbonates, Nitrification, *Blood chemistry, *Tissue analysis.

Exposure of channel catfish fingerlings for 24 h to 1.0, 2.5, and 5.0 mg/L nitrite (pH = 7; hardness -

40 mg/L; temperature = 22-25C) produced methemoglobin levels of 20.7 - 59.8 and 77.4, respectively. However, methemoglobin levels were not elevated when fish were simultaneously exposed to 1.0, 2.5, and 5.0 mg/L nitrite and 25, 50, and 100 mg/L sodium chloride, respectively. Acclimation to sodium chloride for 24 h before exposure to nitrite did not enhance the inhibitory action of sodium chloride. Fish exposed to 5 mg/L nitrite for 5 h developed 42.5 3.8% methemoglobin. When transferred to water containing 5 mg/L nitrite and 250 mg/L sodium chloride, methemoglobin levels returned to normal within 24 h. An ionic ratio of 16 Cl- to 1 NO2 - is capable of complete suppression of nitrite-induced methemoglobin formation. (Deal-EIS)
W80-02384

INTERACTIONS OF CHLORINE, TEMPERATURE CHANGE (DELTA T), AND EXPOSURE TIME ON SURVIVAL OF STRIPED BASS (MORONE SAXATILIS) EGGS AND PROPLARVAE,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
D. T. Burton, L. W. Hall, S. L. Margrey, and R. D. Small.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1108-1113, 1979. 6 Fig, 1 Tab, 24 Ref.

Descriptors: *Striped bass, *Toxicity, *Cholorine, *Water temperature, Fish eggs, Larval growth stage, Mortality, Entrainment, Powerplants, Chlorination, Mathematical models, Statistical analysis, Heated water.

Effects of total residual chlorine (TRC), change in temperature (delta T), and exposure time on eggs, TRC and delta T and exposure time were all found to be important in causing mortality of prolarvae. The study shows that in an evaluation of the potential effects of chlorinated power plant cooling waters to striped bass ichthyoplankton, a systematic study must be made of the interactions of TRC, delta T, and exposure time. (Deal-EIS)
W80-02385

FACTORS INFLUENCING DISTRIBUTION OF MUSSELS IN THE BLANCO RIVER OF CENTRAL TEXAS,
Southwest Texas State Univ., San Marcos. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-02387

SPHAERIIDAE AS INDICATORS OF TROPHIC LAKE STAGES,
Smithsonian Institution, Washington, DC.
For primary bibliographic entry see Field 5C.
W80-02388

STUDIES ON THE TOXICITY OF RIVERS -I TOXICITY OF THE URAKAMI RIVER IN NAGASAKI CITY (IN JAPANESE),
Nagasaki Univ. (Japan). Faculty of Fisheries.
H. Kitamura, T. Kariya, and M. Sato.
Bulletin of the Faculty of Fisheries Nagasaki University, No 47, p 15-20, 1979. 4 Fig, 4 Tab, 8 Ref. (England Summary).

Descriptors: *Toxicity, *Organic wastes, *Chemical oxygen demand, Water quality, Chemical analysis, Seasonal, Water temperature, Flow rates, Water quality standards, Chemical wastes, Productivity, Fish populations, *Japan, Urakami River.

This paper describes the relationship between toxicity and pollution of rivers. The freeze concentration and water quality of the Urakami River in Nagasaki were studied by carrying out toxicity tests. In this research, COD was used as a index for organic pollution. Using the freeze concentration toxicity tests, we were able to determine the toxicity to be 1800% when the solution was 100%. Water samles were collected in May, August, December of 1977 and in February of 1978 at 10 stations along the Urakami River, and the results were as follows: In autumn and winter, water pollution grew worse in comparison with spring and summer. The difference in water temperatures and the volume of the water flow were determined to be the cause. The change in the toxicity was similar to the water quality. The level of toxicity in autumn and winter was considered to be harmful to fish. It was established that there is a close correlation between toxicity and COD, therefore, it is advantagous to restrict the amount of organic polluants being dumped into rivers in order to safeguard the life, quality and productivity of the fish existing in the river. (Deal-EIS)
W80-02389

ACCUMULATION OF COPPER IN CERTAIN BIVALVES OF VELLAR ESTUARY, PORTO NOVO, S. INDIA IN NATURAL AND EXPERIMENTAL CONDITIONS,
Annamalai Univ., Annamalainagar (India). Centre of Advanced Study in Marine Study.
A. K. Kumaraguru, and K. Ramamoorthi.
Estuarine and Coastal Marine Science, Vol 9, p 467-475, 1979. 5 Fig, 6 Tab, 17 Ref.

Descriptors: *Copper, *Absorption, *Commercial shellfish, Chemical analysis, Animal metabolism, Path of pollutants, Water chemistry, Estuarine environment, Oysters, Metals, Spectrophotometry, *Tissue analysis, *Bioaccumulation.

The copper content of three spcies of bivalves of commercial food value, Anadara granosa, Meretrix casta and Crassostrea madrasensis, inhabiting Vellar estuary was determined. Their soft body tissues had copper levels ranging from 7.56 to 11.08 ppm in A. granosa 10.85 to 11.73 ppm M. casta and 15.21 to 18.70 ppm in C. madrasensis on the basis of dry weight. Analysis of different organs (gills, mantle, hepatopancreas, foot and adductor muscles) showed that the gills and mantle contain more copper, suggesting the binding capacity of the mucous protein. These bivalves were experimentally subjected to different copper concentrations (0.02, 0.04, 0.06 and 0.08 ppm) in synthetic sea water media (25 ppt salinity and pH 8.0 + or - 0.1) kept in the laboratory for 96 h, and later analysed for copper both for entire soft body level and for different organs. An increase in copper concentration of the medium increased the accumulation. (Deal-EIS)
W80-02390

GASTROPODS AS INDICATORS OF TROPHIC LAKE STAGES,
Smithsonian Institution, Washington, DC.
A. H. Clarke.
The Nautilus, Vol 94, No 4, p 138-142, 1979. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Gastropods, *Bioindicators, *Trophic level, Lakes, Habitats, Mesotrophy, Oligotrophy, Eutrophication, Niches, Adaptation, Water quality, Spatial distribution, Mulluscs, *Pulmonates.

Field data associated with the 91 species and subspecies of boreal and arctic North American freshwater gastropods were analyzed. Most species and sub-species are eurytopic, but a few are entirely, or nealy, restricted to lakes of particular trophic levels. These are: Valvata sincera sincera for oligotrophic lakes, Fossaria decampi and Stagnicola catascopium for oligotrophic and mesotrophic lakes, and Amnicola limosa, Lymnaea stagnalis jugularis, and Planorbula armigera for eutrophic lakes. Physa integra is frequently associated with mesotrophic lakes but also occurs in other habitats. The indicator species are illustrated and briefly described. (Deal-EIS)
W80-02393

AVOIDANCE OF SEAWATER DILUTIONS OF KRAFT PULP MILL EFFLUENT BY SEAWATER ACCLIMATED PINK SALMON FRY,
Department of Fisheries and Environment, Vancouver (British Columbia). Habitat Protection Div.
G. L. Greer, and G. J. Kosakoski.
Fisheries and Marine Service Technical Report No 831, 1978. 11 p 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Pulp wastes, *Toxicity, *Fish behavior, *Pink salmon, Fry, Growth stages, Chemical wasts, Pulp and paper industry, Bioassay, Salinity, Sea water, Fish physiology.

Seawater acclimated pink salmon fry (Oncorhynchus gorbuscha), were used to measure avoidance of bleached kraft pulp mill effluent (BKME) diluted in sea water. BKME with a 96 h LC50 of 75-80% full strength was avoided at concentrations ranging from 0.8-15.5% full strenght effluent but the avoidance was largely a response to lower salinity of the test water caused by addition of non-saline BKME. A change in behavioural strategy when avoiding seawater dilutions of BKME compared to avoidance of similar dilutions of fresh water in sea water indicated BKME produced some additional effect on the response to lower salinities. (Deal-EIS)
W80-02395

MOLT-RELATED SENSITIVITY OF DAPHNIA PULEX IN TOXICITY TESTING,
Waterloo Univ. (Ontario).
D. R. Lee, and A. L. Buikema, Jr.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 1129-1133, 1979. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Daphnia, *Chromium, *Toxicity, *Growth stages, Bioassay, Mortality, Animal physiology, Mode of action, Analytical techniques, Bioindicators, Embryonic growth stage, *Molting.

Continuous and short-term exposures of Daphnia pulex to 0.56 mg Cr/L showed that these animals undergo cyclic changes in susceptibility. Short-term exposure (2h) followed by transfer to clean water for 22 h resulted in significantly higher mortality for individuals that molted during exposure. Continuous exposure to chromate resulted in significantly shorter mean survival times for animals that had molted <4th before being placed in chromate solution. Because laboratory cultures can be synchronized with respect to molting, the effects of cyclic sensitivity can bias bioassay results. By examining the animals at the beginning of the test, the degree of synchrony can be determined and appropriate steps taken. (Deal-EIS)
W80-02396

TEMPERATURE PREFERENCE OF SEVERAL SPECIES OF SALMO AND SALVELINUS AND SOME OF THEIR HYBRIDS,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
R. H. Peterson, A. M. Sutterlin, and J. L. Metcalfe.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1137-1140, 1979. 3 Tab, 13 Ref.

Descriptors: *Water temperature, *Fry, *Salmonids, Atlantic salmon, Brook trout, Rainbow trout, Lake trout, Growth stages, Fish genetics, Adaptation, Habitats, Thermoclines, *Arctic char.

Temperature preference of newly feeding fry of two species of Salmo, three species of Salvelinus, and seven hybrids were determined in a horizontal gradient. Fry of species in the genus Salmo and intergeneric hybrids with female parent in Salmo selected significantly higher temperatures (13.0 - 15.0C) than did fry of species and hybrids of the genus Salvelinus (9.0-11.5C). No significant differences were obtained among spcies and hybrids within either of the two groups described above. Preferred temperatures of fingerlings (after 3 mo of feeding) of two species and two hybrids within Salvelinus were determined in a vertical temperature gradient. Brook trout preferred 17.5C, and lake trout 10.8C. The two hybrids (brook trout X lake trout and lake trout X brook trout) preferred intermediate temperatures (14.7 and 14.4C). Rainbow trout fingerlings selected 14.7C. (Deal EIS)
W80-02397

GROWTH AND MORTALITY OF THE BLUE MUSSEL (MYTILUS EDULIS) IN RELATION TO ENVIRONMENTAL INDEXING,
Fisheries and Marine Service, Dartmouth (Nova

Scotia). Bedford Inst. of Oceanography.
K. R. Freeman, and L. M. Dickie.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1238-1249, 1979. 5 Fig, 6 Tab, 17 Ref.

Descriptors: *Bioindicators, *Mussels, *Growth rates, *Mortality, Methodology, Productivity, Water quality, Analytical techniques, Size, Seasonal, Genetics, Animal metabolism, Animal physiology, Statistical analysis, Mathematical models, Monitoring.

Comparative production estimates of selected species may provide indices of environmental quality, but so far there is little information on the extent to which production responses are mediated by genotypes. This study used a single source stock of blue mussels to explore differences between two bays. Test animals were held in suspension for 20 mo and growth and mortality observations of size-groups and of identified individuals were made at biweekly intervals. Average growth rates differed slightly between bays but mortality differences were marked and were the principle determinants of net production differences between the bays. Observed growth rates differed markedly between individuals but showed a striking consistency within individuals, indicative of genetic influence on this parameter. Because both mortality and growth interact with body size and season, it is clear that the estimated production levels and differences between bays would be influenced by the mixture of genotypes. We conclude that growth and mortality measures of M. edulis could provide sensitive environmental indices, but growth types in the test stock would need to be standardized. (Deal-EIS)
W80-02399

5B. Sources Of Pollution

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. LOWER COOK INLET INTERIM SYNTHESIS REPORT.
Science Applications, Inc., Boulder, CO.
For primary bibliographic entry see Field 5A.
W80-02053

EXISTING DISTRIBUTION AND CONCENTRATION OF POTENTIAL CONTAMINANTS ASSOCIATED WITH PETROLEUM DEVELOPMENT,
Science Applications Inc., Boulder, CO.
K. W. Fucik.
In: Environmental Assessment of the Alaskan Continental Shelf, Lower Cook Inlet Interim Synthesis Report, p 13-23 July 1979. 7 Fig, 6 Tab, NOAA/OCSEAP-03-7-022-35213.

Descriptors: *Baseline studies, *Water pollution sources, *Water quality, Oil pollution, Seepage, Resources development, Metals, Alaska, *Outer continental shelf, Cook Inlet(AK), Petroleum development, Natural seepage.

The Alaskan marine environment is essentially pristine with regards to petroleum contamination. Hydrocarbons in Lower Cook Inlet are primarily of biogenic origin although some evidence exists for the presence of petroleum hydrocarbons at low levels. Kachemak Bay is an area of potential accumulation of spilled hydrocarbons. Organic carbon levels tend to be high in the sediments of this area, probably because of the hydrographic regime of the bay which restricts the exchange of water and materials with Lower Cook Inlet. Concentrations of petroleum-derived hydrocarbons are highest in the Inlet above the Forelands, indicating a source of petroleum in this area possibly a producing oil field located in this part of the Inlet. Additional petroleum may be entering Lower Cook Inlet from alleged seeps in Kamishak Bay and from coal outcrops and urban inputs in Kachemak Bay. Levels of biogenic hydrocarbons indicate a high biological activity in Kachemak Bay. At the present time, it is probably safe to assume that Lower Cook Inlet is a relatively clean area with respect to the levels of metals contaminants. (See also W80-02053) (Sinha-OEIS)
W80-02054

CONTAMINANTS AND ENVIRONMENTAL DISTURBANCES THAT MAY ACCOMPANY PETROLEUM EXPLORATION AND DEVELOPMENT,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
P. R. Becker.
In: Environmental Assessment of the Alaskan Continestal Shelf, Lower Cook Inlet Interim Synthesis Report, p 27-47 July 1979. 11 Fig, 4 Tab. NOAA/OCSEAP-03-7-022-35213.

Descriptors: *Resources development, *Environmental effects, *Water pollution sources, Oil pollution, Baseline studies, Water pollution, Alaska, Oil spills, *Outer Continental Shelf, Petroleum development, Cook Inlet(AK), Oil tankers.

Oil and gas production has occurred in the upper portion of Cook Inlet (above the Forelands) for about the last ten years, and onshore development has occurred just below the Forelands at Nikiski and Drift River. Information resulting from Cook Inlet's history of OCS development and applied engineering operations can provide more accurate projections of the effects of future OCS development in Lower Cook Inlet. Potential sources of hydrocarbons and associated contaminants are the off-shore platforms, pipelines, shore facilities including tanker terminals, tankers and chemicals that might be employed in the cleanup if an oil spill occurred. Considering the history of oil spills in other geographical areas and the locations of the leased blocks in Lower Cook Inlet, it is probable that the most damaging effect of platforms would come from large-volume acute spills from fires or blow-outs. It is believed that low-volume chronic released from formation waters and accidental small-volume spills would be dispersed fairly rapidly by the strong currents in the central lower Inlet. An important potential result of construction or expansion of onshore facilities is permanent habitat destruction through filling of subtidal areas and maintenance dredging. This could be catastrophic to biological populations both locally and regionally. A potential result of petroleum exploitation in Lower Cook Inlet is an increase in tanker traffic. (See also W80-02053) (Sinha-OEIS)
W80-02055

GEOLOGICAL HAZARDS TO PETROLEUM EXPLORATION AND DEVELOPMENT IN LOWER COOK INLET,
Science Applications, Inc., Boulder, CO.
R. E. Peterson.
In: Environmental Assessment of the Alaskan Continental Shelf, Lower Cook Inlet Interim Synthesis Report, p 51-70, July 1979. 16 Fig, 4 Tab. NOAA/OCSEAP-03-7-022-35213.

Descriptors: *Resources development, *Hazards, *Environmental effects, *Water pollution sources, Oil pollution, Earthquakes, Volcanoes, Alaska, *Outer Continental Shelf, Cook Inlet(AK), Petroleum development.

The potential geological hazards to petroleum industry development in Lower Cook Inlet are earthquake seismicity, tsunamis, volcanic eruptions, and the migration of sand-sized sediment along the seafloor. Through no active faults have been positively identified on the seafloor of the Inlet, shallow faulting is occurring as demonstrated by the distribution and frequency of shallow earthquakes. A substantial earthquake record exists for the Lower Cook Inlet region. The risk of damage due to ground rupture and ground shaking will increase in direct proportion to the increase in offshore structures, pipelines, and onshore facilities, i.e., damage will be proportional to industrial development in this area of very intense seismic activity. Augustine Island is an active volcano of the explosive eruption type. Its most recent eruption in 1976 generated violent explosions with large ash clouds, pyroclastic ash flows with nuees ardentes, and lava flows. hazards to industrial facilities from this volcano include large debris falls, corrosive rains, noxious gas clouds, and seismic seawaves. The distance to which a nuee ardente may travel offshore during a violent eruption is unknown. (See also W80-02053) (Sinha-OEIS)
W80-02056

TRANSPORT AND ALTERATION OF CONTAMINANT DISCHARGES,
Science Applications, Inc., Boulder CO.
E. J. C. Sobey.
In: Environmental Assessment of the Alaska Continental Shelf, Lower Cook Inlet Interim Synthesis Report, p 73-101, July 1979. 26 Fig. NOAA/OCSEAP-03-7-022-35213.

Descriptors: *Resources development, *Transport, *Oil spills, Baseline studies, Environmental effects, Water pollution, Circulation, Alaska, *Outer Continental Shelf, Petroleum development, Cook Inlet(AK).

Limited results obtained from oil spill trajectory models suggest that buoyant material (floating oil) released in central Lower Cook will either accumulate along the western side of the inlet or be transported out of the inlet via Shelikof Strait. The deep circulation is too poorly known to use in predicting trajectories for non-buoyant pollutants. Preliminary results from experiments conducted to determine the accommodation capacity of suspended matter in Cook Inlet indicate that the capacity increases with increasing initial oil concentration and with decreasing temperature. Aggregates of oil and suspended matter tend to be spherical and larger than naturally-occurring particles. The size distribution of suspended matter does not change during the formation of oil/suspended matter aggregates, although the median size increases. Oil/suspended matter aggregates could settle at higher rates than naturally-occurring suspended matter in Lower Cook Inlet. (see also W80-02053) (Sinha-OEIS)
W80-02057

A SYNTHESIS OF ENVIRONMENTAL INFORMATION CONCERNING POTENTIAL OCS OIL AND GAS DEVELOPMENT IN LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
P. R. Becker.
In: Environmental Assessment of the Alaskan Countinental Shelf, Lower Cook Inlet Interim Synthesis Report, p 201-220, July 1979. 11 Fig, 5 Tab, NOAA-OCSEAP-03-7-022-35213.

Descriptors: *Environmental effects, *Resources Development, *Oil pollution, *Baseline studies, Water pollution sources, Water pollution effects, Ecosystems, Aquatic life, Hazards, Alaska, *Outer Continental Shelf, Petroleum development, Cook Inlet(AK).

This section of the Interim Synthesis Report summarizes the information from the previous chapters on potential effects of OCS oil and gas exploration. The major topics covered are OCS development in Cook Inlet, present levels of oil contaminants, major hazards to OCS development, important species and habitats in Lower Cook Inlet and the probably effect on these habitats and species from OCS development. Potential sources of thermogenic hydrocarbons in Cook Inlet include natural oil seeps and coal outcrops, discharges from tankers and other vessels, waste discharges from urban areas, and offshore oil and gas operations. The concentration of thermogenic hydrocarbons in Lower Cook Inlet is very low and is similar to concentrations measured in other Alaskan waters. (See also W80-02053) (Sinha-OEIS)
W80-02059

SEWAGE CONTAMINATION IN THE NEW YORK BIGHT. COPROSTANOL AS AN INDICATOR,
National Oceanic and Atmospheric Administrarion, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
P. G. Hatcher, and P. A. McGillivary.
Environmental Science & Technology, Vol 13, No

10, p 1225-1229, October 1979. 4 Fig, 1 Tab, 22 Ref.

Descriptors: *Sediments, *Water pollution effects, *Sewage disposal, *Water pollution sources, Environmental effects, Domestic wastes, *Outer Continental Shelf, *New York Bight, Ocean dumping, Coprostanol, Anthropogenic components.

Sediments of the New York Bight are analyzed for coprostanol, a fecal steriod, to determine the degree of sewage contamination. Coprostanol, when reported as a percentage of total steriods (% coprostanol), can be quantitatively related to the amount of sewage-derived organic matter. Furthermore, coprostanol is quite persistent in anoxic silts of the Bight and, thus, can be used to delineate historical contamination in these silts. Based on the sediments analyzed, the New York Bight is shown to be highly contaminated with sewage (most likely ocean-dumped sewage sludge), especially in the topographically low areas near the dump site, where black silts have been known to accumulate. (Sinha-OEIS)
W80-02065

OCEANIC DIFFUSION OF A SEVERE ACCIDENTIAL RADIONUCLIDE RELEASE FROM A SUBSEA NUCLEAR POWER PLANT,
Offshore Power Systems, Jacksonville, FL.
S. M. Lainoff, and W. Nachbar.
Energy the International Journal, Vol 2, No 2, p 179-188, June 1977. 1 Fig, 6 Tab, 10 Ref.

Descriptors: *Nuclea powerplants, *Diffusion, *Radioactivity, California, Resources development, Water pollution control, Hazards, Sites, Environmental effects, *Outer Continental Shelf, *Subsea powerplants, Radionuclide release.

Seabed siting of nuclear power plants could reduce significantly the safety problem posed by the severest accident, core melt followed by containment breach, in which a considerable portion of the radionuclide inventory is rapidly released to the environment. At 80 fathoms depth, in addition to a possible sizeable reduction of accident probabilities, the accident consequences to human life are likely to be greatly reduced because the most deadly components of the radioactive cloud from a land-based site will be dissolved for the seabed site. The present paper deals specifically with the oceanic diffusion of dissolved radionuclides following a severe accident (the specifications for the reference accident PWR-2 of WASH-1400 are taken) at a site chosen off the coast of San Diego, California. (Sinha-OEIS)
W80-02067

ENVIRONMENTAL IMPACT ASSESSMENT FOR OTEC-1,
TRW Defense and Space Systems Group, Redondo Beach, CA.
L. Sinay-Friedman.
In: 'Ocean Thermal Energy for the 80's,' Preprints Volume II, 6th OTEC Ocean Thermal Energy Conversion Conference, held in Washington, DC on June 19-22, 1979. DOE CONF-790631/2, p 5C-2/1 - 5C-2/6, 1979. 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Energy conversion, *Environmental effects, *Resources development, Baseline studies, Water quality, Water pollution sources, *Outer Continental Shelf, *Ocean Thermal Energy Conversion(OTEC), Environmental impact, Biological impact.

Operation of a one megawatt electric (Mwe) set of OTEC heat exchangers aboard the OTEC-1 Early Ocean Test Platform, approximately 39 kilometers (km) northwest of Kawaihae, Hawaii will begin in April 1980 and continue for three and one-half years. In accordance with the National Environmental Policy Act (NEPA) of 1969, governmental activities must consider environmental impacts resulting from the project by preparing an Environmental Impact Assessment (EIA). This paper presents the latest results of the OTEC-1 Environmental Impact Assessment Study. The key environmental issues considered applicable to OTEC-1 which were assessed during the study relate to: (1) organism entrainment; (2) organism impingement; (3) ocean water mixing; (4) platform attraction; (5) chlorine releases; (6) ammonia leakage to the sea; (7) oil spills; (8) atmospheric pollution; (9) endangered species; and (10) socioeconomics. Major concerns have focused on the biological impacts. The OTEC-1 tests involve no electrical power generation, and negligible extraction of heat from the ocean. Nearfield effects of OTEC-1 will be localized and negligible in view of the broad distribution of pelagic organisms. Farfield effects could reach nearshore populations whose habitats may be more restricted, although this is not expected. (Sinha-OEIS)
W80-02073

OTEC PHYSICAL AND CLIMATIC ENVIRONMENTAL IMPACTS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
J. D. Ditmars, and R. A. Paddock.
In: Ocean Thermal Energy for the 80's, Preprints Volume II. 6th OTEC Ocean Thermal Energy Conversion Conference, held in Washington, DC on June 19-22, 1979. DOE Conf-790631/2, p 6A-3/1 - 6A-3/8, 1979. 21 Ref.

Descriptors: *Energy conversion, *Resources development, *Environmental effects, Water quality, Baseline studies, Effluents, Climates, Gulf of Mexico, Models, *Outer Continental Shelf, *Ocean Thermal Energy Conversion(OTEC), Heat exchange, Thermal resources.

Assessment of Ocean Thermal Energy Conversion (OTEC) environmental impacts and resource utilization requires an understanding of the physical processes underlying the interactions between an OTEC plant or plants and the ocean. This paper presents an overview of the U.S. Department of Energy program for the development and application of analyses and models for the prediction of the physical aspects of OTEC impacts. Prodictive tools are necessary to address problems at different site areas, scales of OTEC deployment, and time horizons. The effects of intake/discharge designs and of ambient ocean conditions on recirculation and near-field effluent plume behavior have been investigated by means of physical models. Further study of the intake flow fields may be necessary to make estimates of intake impingement and entrainment effects. Mathematical analysis of intermediate-field mixing of plant effluents has shown that effluent plumes may have vertical dimensions on the order of meters and lateral dimensions on the order of kilometers. Models of oceanic regional and island coastal circulation are required to investigate far-field effects on the scale of tens of kilometers. Basin-wide resource renewal and physical environmental effects are being studied by means of a numerical model of the Gulf of Mexico with detailed vertical resolution. Concerns regarding climatic impacts presently are focused on atmospheric CO2 loading and modification of air-sea heat exchange processes due to OTEC operation. (Sinha - OEIS)
W80-02074

EFFECT OF CRUDE OIL AND DETERGENT 'SOLO' ON THE ACTIVITY OF SOME HYDROLASES IN HEMOLYMPH OF CRAB RHITHROPANOPEUS HARRISI,
Medical Academy, Gdansk (Poland). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-02079

PHYSIOLOGICAL AND BEHAVIOURAL CHARACTERIZATION OF THE ACTION OF CHLORFENVINPHOS ON FISH LEBISTES RETICULATUS PETERS,
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergetics.
R. J. Wroblewski.
Polskie Archiwum Hydrobiologii, Vol 26, No 3, p 427-456, 1979. 18 Fig, 6 Tab, 75 Ref.

Descriptors: *Pesticide toxicity, *Fish behavior, *Bioassay, Respiration, Feeding rates, Growth rates, Mode of action, Monitoring, Juvenile growth stage, Fish physiology, Insecticides, Organophosphorus pesticides, *Chlorfenvinphos, Guppies.

Classical acute toxicity tests as well as behavioural and physiological tests were performed. On account of the low (2.7-1.4 mg/l) values of index LC 50-24 h, chlorfenvinphos can be considered highly toxic to juvenile guppies. Five syndromes of behavioural symptoms of the severity of poisoning were distinguished. During exposure to poison, the sequence of syndromes was the same, both upon prolongation of exposure time and upon an increase in concentration. When fish were transferred to pure water, the first three syndromes receded in opposite sequence, whereas the two syndromes of more severe poisoning proved to be irreversible. Physiological indices of posioning (food consumption, growth and respiration) were determined in fish transferred to pure water. Changes in food consumption proved to be the best index of poisoning. The suitability of various tests for biomonitoring and evaluation of the toxicodynamic properties of pesticides was discussed. (Deal-EIS)
W80-02084

TOXICITY AND RETENTION OF DDT IN ADULT FROGS, RANA TEMPORARIA L.,
Kuopio Univ., (Finland).
M. N. E. Harri, J. Laitinen, and E-L. Valkama.
Environmental Pollution, Vol 13, p 45-55, 1979. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Frogs, *DDT, *Toxicity, Absorption, Mortality, Mode of action, Pesticide residues, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Path of pollutants, Carbon radioisotopes, Tracers, Animal metabolism, Enzymes, *Tissue analysis, *Bioaccumulation.

The acute LD50 value of DDT in adult summer frogs was only 7.6 mg/kg. The symptoms of poisoning caused by DDT point to nervous damage. The toxicity was further increased by starving. The retention of DDT was followed using (14C)-labelled DDT. It accumulated most in tissues containing fat. Thus the fat body and lever retained much of the DDT while only a very small amount was found in skeletal or heart muscle. In female frogs a large quantity of DDT is stored in the overy, its large size and high fat content possibly accounting for this phenomenon. Moderate amounts of DDT were found in kidneys and nervous tissue. In addition, an auto-radiographical study revealed considerable radioactivity in bones and spleen. Starved animals retained higher amounts of DDT in their tissues, with the exception of the fat body, than did the fed animals. DDT was found to disappear extremely slowly. Its disappearance was, however, enhanced by previous DDT treatment since DDT-treated animals retained much less of the test dose than did the untreated controls. It is thus possible that DDT induces the activity of drug-metabolising enzymes which may lead to increased biliary excretion of the drug. (Deal-EIS)
W80-02090

CADMIUM IN MYTILUS EDULIS FROM GERMAN COASTAL WATERS,
Institut fuer Meereskunde, Bremerhaven (Germany, F.R.).
H. Theede, I. Andersson, and W. Lehnberg.
Meeresforschung, Vol 27, No 3, p 147-155, 1979. 5 Fig, 3 Tab, 25 Ref.

Descriptors: *Cadmium, *Mussels, *Baseline studies, Heavy metals, Chemical analysis, Size, Benthic fauna, Spectrophotometry, Kiel, Animal meatbolism, Path of pollutants, Bottom sediments, Water chemistry, *Tissue analysis, *Mytilus, *Baltic Sea, *Bioaccumulation.

In numerous places on the German Baltic coast the cadmium content of the edible common mussel Mytilus edulis is higher than in individuals from the North Sea Coast. The highest cadmium content is found in mussels from the innermost part of the Kiel Fjord. Speciments from the outer parts of the Keil and Flensburg Fjord contain less cadmi-

um. Further, mussels from pier timbers have considerably lower cadmium concentrations than those from the neighbouring sediment. Within the size range of 0.05-0.5 g dry weight there is a tendency for the smaller specimens to have a higher cadmium concentration. In the mussels' organs the concentration decreases in the following order: digestive diverticula, kidney, gills, adductor muscle, mantle with gonads, foot. (Deal-EIS)
W80-02094

INFLUENCE OF THE MODE OF CONTAMINATION ON THE SUBSEQUENT ELIMINATION OF COBALT 60 BY A PHANEROGAME, A MOLLUSC, A CRUSTACEAN AND BY A FRESHWATER FISH (IN FRENCH),
Laboratoire de Biologie Marine, Nantes (France) Faculte des Sciences.
C. Amiard-Triquet.
Environmental Pollution, Vol 13, p 65-78, 1979. 4 Fig, 3 Tab, 32 Ref.

Descriptors: *Path of pollutants, *Aquatic plants, *Cobalt radioisotopes, Nuclear powerplants, Absorption, Radioactive wastes, Cobalt, Aquatic environment, Food webs, Metabolism, Carp, *Elodea.

60C enters the environment with radioactive wastes from nuclear power reactors and fuel reprocessing plants as well as a component of fallout from nuclear tests. A study of 60C in freshwater organisms has been carried out in order to compare the influence of different modes of uptake (immersion in contaminated water, ingestion of radioactive food, contamination by both food and water) upon the subsequent elimination. The loss of 60C by Canadian pondweed Elodea canadensis is monophasic. For animal species, this phenomenon is biphasic, independently of the mode of uptake. On the other hand, the biological half-life changes in relation to the vector of contamination. The same result is observed for the relative importance of the different compartments. This is easily explained because the mode of uptake determines the distribution of 60C in the organisms. The turnover of 60C in the organisms is slow and the physical half-life of this radionuclide is relatively important (Tp = 5.27 years). Thus, the possible consequences of the release of this pollutant on freshwater life must not be neglected. (Deal-EIS)
W80-02098

EFFECTS OF TOXIC AMOUNTS OF DIETARY ZINC ON THE GROWTH AND BODY COMPONENTS OF RAINBOW TROUT AT TWO LEVELS OF CALCIUM (IN JAPANESE).
Freshwater Fisheries Research Lab., Tokyo (Japan).
For primary bibliographic entry see Field 5A.
W80-02102

AN ASSESSMENT OF KNOWLEDGE CONCERNING THE FATE AND EFFECTS OF PETROLEUM HYDROCARBONS IN THE MARINE ENVIRONMENT,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
For primary bibliographic entry see Field 5A.
W80-02107

THE EFFECT OF NAPHTHALENE ON SYNTHESIS OF PEPTIDE ANTIFREEZE IN THE BERING SEA SCULPIN, MYOXOCEPHALUS VERRUCOSUS,
Illinois Univ. at Urbana-Champaign. Dept. of Physiology and Biophysics.
For primary bibliographic entry see Field 5A.
W80-02108

PESTICIDES: THEIR IMPACT ON THE ESTUARINE ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-02109

COMPARATIVE METABOLISM OF PARATHION BY INTERTIDAL INVERTEBRATES,
California Univ., Davis. Dept. of Environmental Toxicology.
For primary bibliographic entry see Field 5A.
W80-02110

BIOACCUMULATION OF DDT AND PCB IN TISSUES OF MARINE FISHES,
Environmental Research Lab., Gulf Breeze, FL.
P. A. Butler, and R. L. Schutzmann.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials. STP 667, p 212-220, 1979. 7 Tab, 11 Ref.

Descriptors: *DDT, *Polychloride biphenyls, *Marine fish, Pesticide residues, Pesticide kinetics, Commercial fish, Chemical analysis, Path of pollutants, Fish physiology, Persistence, DDE, *Bioaccumulation, *Tissue analysis.

Fishes of commercial importance were monitored in New England coastal waters in 1974 to determine whether synthetic organic residues in the fish were large enough to affect the utilization of such fish as food by man or to interfere with their ability to reproduce. About 700 fish of 20 species were pooled in samples of five to ten, and the livers were analyzed. Several species, including the spiny dogfish, contained residue of dichlorodiphenyltrichloroethane (DDT) and its metabolites and of polychlorinated biphenyl (PCB) compounds in the 1 to 10 microg/g (ppm) range. More detailed studies of the dogfish in 1975 demonstrated the transfer of these compounds from the parent fish to the ovarian egg and the mature fetus. The proportions of the DDT metabolites found suggest that this pesticide had been accumulating in the 18 to 20 year period of maturation of the female and was passed on to the first brood of young. In contrast to the findings of other investigations, there was no fixed relationship in the relative magnitude of DDT and PCB residues when both compounds were present in a sample. (Deal-EIS)
W80-02112

TEST OF A MODEL FOR PREDICTING KEPONE ACCUMULATION IN SELECTED ESTUARINE SPECIES,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-02113

CONSIDERATIONS IN ASSESSING THE POTENTIAL FOR, AND SIGNIFICANCE OF, BIOMAGNIFICATION OF CHEMICAL RESIDUES IN AQUATIC FOOD CHAINS,
EG and G Bionomics, Wareham, MA.
For primary bibliographic entry see Field 5A.
W80-02115

EFFECTS OF CALCIUM AND SEDIMENT CONCENTRATIONS ON THE RELEASE OF METALS AND NUTRIENTS FROM DREDGE SPOIL DISPERSIONS,
Corps of Engineers, Detroit, MI. Detroit District.
For primary bibliographic entry see Field 5A.
W80-02119

ECOLOGICAL KINETICS OF SILVER IN AN ALPINE LAKE ECOSYSTEM,
Thomas Hunt Morgan School of Biological Sciences, Lexington, KY.
R. A. Freeman.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials STP 667, p 342-358, 1979. 6 Fig, 6 Tab, 31 Ref.

Descriptors: *Seasonal, *Ecosystems, *Metals, Chemical properties, Chemical analysis, Path of pollutants, Climatology, Aquatic environment, Alpine, Fallout, Rocky Mountain region, *Silver, *Bioaccumulation.

The cycling characteristics of silver were studied in a small watershed and lake in the Colorado alpine region. The sources of silver for the watershed were atmospheric fallout and washout, groundwater percolation, and cloud seeding. Monthly synoptic samples of snow, stream and lake water, groundwater, soil, sediment, sediment interstitial water, aquatic plants, benthos, seston, and fish were analyzed for two years. The biological samples were subjected to acid digestion while ammonium pyrrolidine dithiocarbamate-methyl isobutyl ketone extractions were performed on the aqueous samples. Silver in the sediment was extracted by iodide complexation. The silver concentrations showed marked seasonal variations in all ecosystem components studied, and this implied a partially reversible mechanism of bioaccumulation. Variations in silver concentration in the ecosystem components were statistically correlated on the basis of their physical and biological interactions, and these correlations provide a framework for an annual silver cycle. A chain of effects initiated by terrestrial climatological events is hypothesized to be causal in the levels of silver which eventually appear in aquatic biota and environments. (Deal-EIS)
W80-02120

TRANSPORT AND TRANSFORMATIONS OF ANTHRACENE IN NATURAL WATERS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5A.
W80-02121

THE EFFECT OF PLANTS AND ANIMALS ON THE CHEMISTRY OF ESTUARINE SEDIMENTS,
Cape Town Univ. (South Africa). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02122

ORGANOCHLORINE CONTAMINANTS AND TRENDS IN REPRODUCTION IN GREAT LAKES HERRING GULLS, 1974-1978,
Department of Fisheries and Environment, Burlington (Ontario).
D. V. Weseloh, P. Mineau, and D. J. Hallett.
Transactions of the Forty-fourth North American Wildlife and Natural Resources Conference, p 543-557, 1979. K. Sabol, Ed. 2 Fig, 4 Tab, 37 Ref.

Descriptors: *Pesticide residues, *Gulls, *Bird eggs, *Great Lakes, Chlorinated hydrocarbon pesticides, DDT, Polychlorinated biphenyls, Dieldrin, DDE, Reproduction, Pesticide kinetics, Persistence, *Lake Ontario, *Lake Erie, *Lake Huron, *Lake Superior, Fecundity, Hatching, *Mirex, *HCB, *Tissue analysis.

Herring gull eggs were monitored for levels of the major organochlorine residues in two colonies from each of Lakes Ontario, Erie, Huron and Superior during 1974, 1975, 1977 and 1978. Colonies of Lake Ontario were the most contaminated followed by Lakes Huron and Superior with Lake Erie as the least contaminated. Since 1974 significant decreases were evident in levels of DDT, mirex and PCBs, at all colonies and most colonies showed similar decreases for dieldrin, DDE and HCB. One significant increase was noted for DDT for Granite Island (Lake Superior) between 1977 and 1978. Reproductive success of herring gulls was determined on all colonies in 1978 and on selected colonies prior to that. Reproductive success has shown a substantial improvement on Lakes Erie and Ontario. It was directly paralleled by a decline in the major organochlorine residues. Reproductive success on Lake Huron and Lake Superior has remained relatively high. Continued monitoring of residue levels and the reproductive success of herring gulls will serve to indicate trends in contamination by persistent toxicants and in the overall health of the Great Lakes ecosystem. Trends from 1974 to 1978 show a general improvement. (Deal-EIS)
W80-02123

THE EFFECT OF TILLAGE SYSTEMS ON PESTICIDES IN RUNOFF FROM SMALL WATERSHEDS,

Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W80-02147

PHYSIOLOGY OF SALINITY-DEPENDENT NAPHTHALENE TOXICITY IN FUNDULUS HETEROCLITUS,
Delaware Univ., Newark. Coll. of Marine Studies.
W. M. Levitan, and M. H. Taylor.
Journal of the Fisheries Research Board of Canada, Vol 36, No 6, p 615-620, 1979. 5 Fig, 22 Ref. OWRT A-043-DEL(2), 14-34-0001-9008.

Descriptors: *Fundulus heteroclitus, Mummichogs, *Salinity, Mortality, Toxicity, Naphthalene, Respiration, Metabolism, Bioassay, Estuaries, Fish Physiology, Environmental effects, Toxins, Osmotic imbalance, Laboratory tests, Organic compounds, Cortisol.

The influence of salinity on mortality in mummichogs, Fundulus heteroclitus, subjected to naphthalene and the physiological bases for the salinity-dependent mortalities were determined. Fish were acclimated to five salinities, 2, 8, 15, 23, and 33 ppth, and exposed to 6 and 4 mg naphthalene/L. At 4 mg/L, fish survival was greater at hypo- and near isoosmotic (15 ppth) salinities than at hyperosmotic salinities. At 6 mg/L, survival was generally greatest at 8 and 15 ppth and decreased at the salinity extremes. In fish exposed to 4 mg naphthalene/L, uptake was more rapid at the iso- and hyperosmotic salinities than at hypoosmotic salinities and osmotic imbalance occurred only at hyperosmotic salinities. Serum cortisol levels and oxygen consumption rates increased at all salinities upon exposure to 4 mg naphthalene/L. However, the most significant increases in oxygen consumption rates occurred at hyperosmotic salinities. Thus, the greater naphthalene uptake, osmotic imbalance, and metabolic stress occurring at hyperosmotic salinities may contribute to the increased mortality of naphthalene-exposed fish acclimated to hyperosmotic salinities. (D. Katz-EIS)
W80-02150

WATER QUALITY ASSESSMENT OF THE TRIBUTARIES TO THE FOX CHAIN OF LAKES,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 5A.
W80-02168

NUTRIENT BUDGET AND ITS CRITICAL EVALUATION FOR THE FOX CHAIN OF LAKES,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Transactions of the Illinois State Academy of Science, Vol 71, No 3, p 273-285, November 1978. 1 Fig, 5 Tab, 10 Ref.

Descriptors: *Water quality, *Nutrients, *Water pollution sources, *Sampling, *Illinois, Nitrogen, Phosphorus, Precipitation(Atmospheric), Septic tanks, Sewage, Effluents, Pollutants, Path of pollutants, Water pollution, Lakes, Rivers, *Fox Chain of Lakes(IL).

The Fox Chain of Lakes receives approximately 6370 kg/day of total nitrogen and 730 kg/day of phosphorus. Of the total phosphorus and total nitrogen, about 130 kg/day of phosphorus and 375 kg/day of nitrogen emanate from point sources of waste discharges. The Fox River transports about 70% of inorganic nitrogen, and together with Nippersink and Squaw Creeks contributes about 93% of the total inorganic nitrogen. Also, these three tributaries contribute 86% of the dissolved orthophosphorus. About 27% of total nitrogen and 37% of total phosphorus influx into the lake system are retained in the lakes. The impacts of septic tank systems and precipitation were found to be equal as far as total phosphorus is concerned. The net loading rates, considering only the readily available nitrogen and phosphorus retained in the lakes, were found to be 17.4 g/sq m/yr and 1.5 g/sq m/yr, respectively, for nitrogen and phosphorus. These loading rates, computed on the basis of lake surfaces, were several orders of magnitude in excess of rates for these nutrients which the lakes could absorb without showing the symptoms of eutrophication. It was estimated that phosphorus recycled from the sediments in deep water areas of the Fox Chain alone appears to be adequate for sustaining algal blooms for a long period of time. (Sims-ISWS)
W80-02169

A SIMPLIFIED STATISTICAL SEQUENCE APPLIED TO ROUTINE WATER QUALITY ANALYSIS: A CASE HISTORY,
International Minerals and Chemical Corp., Detroit, MI.
G. A. Alther.
Ground Water, Vol 17, No 6, p 556-561, November-December 1979. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Water pollution, *Water quality, *Path of pollutants, *Statistical analysis, Sewage, Effluents, Sewage effluents, Streams, Sampling, Data processing, Chemicals, Calcium, Magnesium, Sodium, Potassium, Chlorine, Nitrates, Dissolved oxygen, Hardness(Water), Statistics, Analytical techniques.

A sequence of simple statistical tests was used to interpret the data from a routine water sampling project for a stream that was contaminated with effluent from a sewage treatment plant. The contamination of this stream was apparent from the murky condition of the water and its pungent odor. The outlet of the sewage treatment plant enters the stream at its origin. The chemical variables analyzed were Ca, Mg, Na, K, Cl, nitrates, TDS, and hardness. Background data from other streams in this drainage basin and data from the stream under investigation were subjected to cluster analysis in order to classify the sampled area into geochemical provinces. The contaminated stream under investigation comprised one province, and the background streams constituted another province. A linear regression performed on the data showed a statistically significant decrease of several variables with increasing distance from the outlet of the sewage treatment plant. An abrupt decrease in concentration of iron some 450 m below the plant outlet implied the presence of two populations with different means, which was statistically verified with a trimmed t-test. Use of these simple tests greatly facilitated interpretation of the data. (Sims-ISWS)
W80-02172

GROUND-WATER POLLUTION BY TRANSFER OF OIL HYDROCARBONS,
Strasbourg Univ. (France). Inst. de Mecanique des Fluides.
J. J. Fried, P. Muntzer, and L. Zilliox.
Ground Water, Vol 17, No 6, p 586-594, November-December 1979. 6 Fig, 46 Ref.

Descriptors: *Water pollution, *Soil contamination, *Oil, *Organic compounds, Oil spills, Porous media, Pollutants, Path of pollutants, Soils, Laboratory tests, Mathematical models, Aquifers, Groundwater, Groundwater movement, Fluid mechanics, Oil hydrocarbons.

An important aspect of the pollution of a phreatic aquifer by hydrocarbons is the oil-water contact and transfer of soluble substances from the oil into the groundwater. A systematic study of this transfer of matter in a saturated porous medium (initial condition of contact when the impregnation body is submitted to fluctuations of the piezometric level) was performed with an experimental device made up of a porous matrix containing the oil phase, steady and crossed by a unidirectional flow of water. The transfer was very efficient; for all compounds which have been studied, the maximum possible concentration was reached after a distance of the order of 10 cm with specific flow rates greater than those generally encountered in a gravel-sand aquifer. The selective impoverishment of the oil product with time, due to differences in the solubility of various hydrocarbons, modified the dissolved phase composition. Downstream of an in-situ impregnation body, this phenomenon only appears after a constant concentration has been reached for a long time. A source model was thus obtained where the pollutant massic flow rate was proportional to the flow rate of the water which crosses the impregnation body. Such an initial condition has a fundamental effect on the determination of the contaminated aquifer domain, with the help of the dispersion scheme, with hydrocarbon concentrations evolving according to a general diffusion-convection law. (Sims-ISWS)
W80-02173

PREDICTING LEVEL OF DISSOLVED REACTIVE PHOSPHATE IN THE LAFAYETTE RIVER, VIRGINIA, FROM INFORMATION ON TIDE, WIND, TEMPERATURE, AND SEWAGE DISCHARGE,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
J. R. Montgomery.
Water Resources Research, Vol 15, No 5, p 1207-1212, October 1979. 5 Fig, 1 Tab, 33 Ref, 1 Append.

Descriptors: *Water chemistry, *Phosphates, *Estuaries, *Virginia, Sampling, Data processing, Model studies, Mathematical models, Forecasting, Rivers, Tidal waters, Phosphorus compounds, Oxygen, Dissolved oxygen, Temperature, Water temperature, Salinity, Sediments, Sewage, Water pollution, Water pollution sources, *Lafayette River(VA).

The Lafayette River in Norfolk, Virginia, is a shallow, turbid, urban estuary, polluted with primary treated sewage. The river was sampled monthly from October 1970 to January 1972. Oxygen, temperature, and salinity values are vertically and laterally homogeneous in the Lafayette River. The mean values of dissolved reactive phosphate (DRP) in the Lafayette River for the winter (1970-1971 and 1972), ranged from 2.2 to 5.8 microgram-atoms per liter and for the summer of 1971, 7.6 microgram-atoms per liter. Multiple linear regression models were prepared to relate the daily changes in phosphate to tide stage, wind component, and rate of phosphate discharge (kg/hr) from the Lamberts Point sewage treatment plant. The equations for the August 1971 sample showed that the effect of the tide stage is 3 times as important in the determination of the levels of DRP as the rate of flow of DRP from the sewage effluent on the ebbing tide and is equally important as the rate of flow of DRP from the sewage effluent on the flooding tide. The daily variations in DRP are more noticeable in the summer because of the higher concentrations of phosphate in the Lafayette River during this season. The increase of phosphate on the ebb tide and the decrease on the flood tide over a daily cycle was attributed to a dilution of the waters of the Lafayette River by the water from Hampton Roads. The direct relation of water temperature to the concentration of DRP for the seasonal model was attributed to the increased biochemical activities of the micro-organisms in the sediment-water system. (Sims-ISWS)
W80-02178

ESTIMATING SOLUTE TRANSPORT IN STREAMS FROM GRAB SAMPLES,
Pennsylvania Univ., Philadelphia. Dept. of Landscape Architecture and Regional Planning.
A. H. Johnson.
Water Resources Research, Vol 15, No 5, p 1224-1228, October 1979. 4 Fig, 3 Tab, 9 Ref.

Descriptors: *Sampling, *Path of pollutants, *Phosphorus, Streamflow, Discharge(Water), Data processing, Analytical techniques, Regression analysis, Nutrients, Water pollution, Pollutants, On-site investigations, Water pollution sources, Grab samples.

Several combinations of weighting procedures and schedules of sample collection resulted in substantial differences in calculated P transport by Fall Creek, New York. Calculation of P flux using regressions of concentration on flow is the most satisfactory for grab sample studies where solute concentration is correlated with stream discharge because regressions account for solute export at

the highest flows better than other methods. Acceptable estimates of yearly solute flux in a stream can probably be obtained from samples collected weekly and representing all flow stages. (Sims-ISWS)
W80-02180

SHORT-TERM COVARIABILITY OF CHLOROPHYLL AND TEMPERATURE IN THE ST. LAWRENCE ESTUARY,
Laval Univ., Quebec. Dept. de Biologie.
For primary bibliographic entry see Field 2L.
W80-02184

MISSISSIPPI RIVER SHOALING: A DIAGNOSTIC STUDY,
Iowa Univ., Iowa City, Inst. of Hydraulic Research.
For primary bibliographic entry see Field 2E.
W80-02186

EVIDENCE OF ACIDIFICATION OF HEADWATER STREAMS IN THE NEW JERSEY PINELANDS,
Pennsylvania Univ., Philadelphia.
A. H. Johnson.
Science, Vol 206, No 4420, p 834-835, November 16, 1979. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Acid streams, *Natural streams, *Water pollution, *New Jersey, Hydrogen ion concentration, Headwaters, Data collections, Analysis, Water quality, Small watersheds, *Oyster Creek(NJ), *McDonalds Branch(NJ).

Seventeen years of stream pH data indicate a trend of acidification in two small streams, McDonalds Branch and Oyster Creek, in the New Jersey Pine Barrens which drain relatively undisturbed areas. The decline in pH has amounted to approximately 0.4 unit, with an estimated increase in H(+) concentration of about 50 microequivalents per liter. The data collected to date are consistent with the postulation of an atmospheric source for the increased H(+). (Humphreys-ISWS)
W80-02190

DISTRIBUTION, RESIDENCE TIME, AND FLUXES OF TETRACHLOROETHYLENE AND 1,4-DICHLOROBENZENE IN LAKE ZURICH, SWITZERLAND,
Eidgenossische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschut Zurich (Switzerland).
R. P. Schwarzenbach, E. Molnar-Kubica, W. Giger, and S. G. Wakeham.
Environmental Science and Technology, Vol 13, No 11, p 1367-1373, November 1979. 4 Fig, 3 Tab, 45 Ref.

Descriptors: *Lakes, *Water quality, *On-site investigations, *Water pollution, Distribution, Mass transfer, Water sampling, Testing procedures, Analytical techniques, Variability, Seasonal, Chemical analysis, Epilimnion, Hypolimnion, Flow, *Lake Zurich(Switzerland), Residence time, Tetrachloroethylent, 1,4-Dichlorobenzene.

A 1-year study of tetrachloroethylene and 1,4-dichlorobenzene in Lake Zuich, Switzerland, has been conducted. The seasonal distribution of the compounds, which are continuously introduced to the lake at different locations, reflects the circulation in the lake and is compatible with the assumption derived from laboratory studies that mass transfer to the atmosphere is the predominant elimination mechanism. A mass balance for 1,4-dichlorobenzene has been established for the central basin of the lake, and an average residence time of approximately 5 months has been found. By applying a simple steady-state model, an average annual mass transfer coefficient of 1 cm/h was obtained for the transport of 1,4-dichlorobenzene and tetrachloroethylene from the lake to the atmosphere. (Humphreys-ISWS)
W80-02193

UNSATURATED FLOW BENEATH TAILINGS IMPOUNDMENTS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 2F.
W80-02195

STRESS AND CHRONIC EFFECTS OF UNTREATED AND TREATED BLEACHED KRAFT PULPMILL EFFLUENT ON THE BIOCHEMISTRY AND STAMINA OF JUVENILE COHO SALMON (ONCORHYNCHUS KISUTCH),
British Columbia Research Council, Vancouver. Div. of Applied Biology.
D. J. McLeay, and D. A. Brown.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1049-1059, 1979. 2 Fig, 3 Tab, 62 Ref.

Descriptors: *Sockeye salmon, *Toxicity, *Pulp wastes, Growth rates, Fish physiology, Animal metabolism, Biochemistry, Juvenile growth stage, Proteins, Fish behavior, Chemical analysis, Waste treatment, Chemical wastes, *Pulp and paper industry, Mode of action, Mortality, *Blood chemistry, Tissue analysis.

Growth of juvenile coho salmon fed a limiting ration (70% of satiation) in experimental stream channels was not altered significantly by prolonged exposure to untreated or laboratory-treated (fermented) bleached Kraft-pulpmill effluent (BKME), although mean weights for control fish were consistently lower than those for all effluent-exposed groups from 100 to 200 d. Body protein, fat, and moisture content were unaffected by treatment at 30, 90, and 200 d. Fish exposed to all strengths of untreated or treated BKME (i.e. untreated concentrations equivalent by volume to 0.05, 0.1, 0.2, 0.3, and 0.5 of the untreated effluent's 96-h LC50 value; and treated concentrations equivalent by volume to 0.2 and 1.0 LC50) showed significant decreases in serum albumin levels at 30 d, whereas these recovered to control values at 90 and 300 d. The serum electrolytes Na+, K+, and Ca++ were unaffected by treatment at 200 d and not measured for other exposures. Liver and muscle glycogen reserves were decreased significantly by continuous exposure of fish to untreated or treated BKME concentrations for 30 d. These values recovered to control levels at 90 d and were unaffected or depressed at 200 d. Based on the changes in intermediary metabolism for BKME-exposed fish at 30, 90, and 200 d, it was concluded that these fish remained in a state of chronic stress and did not acclimate to prolonged exposure to pulpmill effluent. Treatment of this waste reduced or removed its acute (lethal) toxicity but did not alter the biochemical effects caused by chronic exposure. (Deal-EIS)
W80-02211

MEASURING AND ESTIMATING THE BIOCONCENTRATION FACTOR OF CHEMICALS IN FISH,
Environmental Research Lab.-Duluth, MN.
G. D. Veith, D. L. DeFoe, and B. V. Bergstedt.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1040-1048, 1979. 3 Fig, 4 Tab, 23 Ref.

Descriptors: *Analytical techniques, *Path of pollutants, *Pollutant identification, Chemical analysis, Organic compounds, Minnows, Absorption, Chemical properties, Laboratory tests, Fish physiology, Animal metabolism, Aroclors, Rainbow trout, Sunfishes, Pesticide residues, *Bioconcentration, *Tissue analysis, *Bioaccumulation, *Hexachlorobenzene.

A method of estimating the bioconcentration factor of organic chemicals in fathead minnows (Pimephales promelas) is described. Water at 25C was intermittently dosed with the chemical at a nontoxic concentration in a flow-through aquarium. Thirty minnows are placed in the aquarium, and composite samples of five fish are removed for analysis after 2, 4, 8, 16, 24, and 32 d of exposure. The bioconcentration process is summarized by using the first-order uptake model, and the steady-state bioconcentration factor is calculated from the 32-d exposure. A structure-activity correlation between the bioconcentration factor (BCF) and the n-octanol/water partition coefficient (P) of individual chemicals is summarized by the equation log BCF = 0.85 log P - 0.70, which permits the estimation of the bioconcentration factor of chemicals to within 60% before laboratory testing. The facilities and resources for testing need be used only for those chemicals that are likely to result in substantial bioconcentration in organisms. The bioconcentration factors derived from tests of mixtures of chemicals are shown to be the same as those derived from tests with the chemicals individually. (Deal-EIS)
W80-02212

MECHANISMS OF COPPER TOLERANCE IN THE MARINE FOULING ALGA ECTOCARPUS SILICULOSUS- EVIDENCE FOR AN EXCLUSION MECHANISM,
Manchester Polytechnic Lancashire (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-02213

CHLORINATED PARAFFINS-AN ENVIRONMENTAL HAZARD,
National Swedish Environment Protection Board, Studsvik. Brackish Water Toxicology Lab.
For primary bibliographic entry see Field 5A.
W80-02214

MERCURY IN WATER AND FISH FROM THE SAO VINCENTE ESTUARY NEAR SANTOS, BRAZIL,
Instituto de Pesca, Santos (Brazil). Coordenadoria de Pesquisa de Recursos Naturais,
For primary bibliographic entry see Field 5A.
W80-02215

ISOLATION AND IDENTIFICATION OF A CONJUGATED-PCP EXCRETED IN THE URINE OF GOLDFISH,
Kyushu Univ., Fukuoka (Japan). Lab. of Fisheries and Chemistry.
For primary bibliographic entry see Field 5A.
W80-02218

HEAVY METALS IN THE SEA-SKATER HALOBATES ROBUSTUS FROM THE GALAPAGOS ISLANDS: CONCENTRATIONS IN NATURE AND UPTAKE EXPERIMENTS, WITH SPECIAL REFERENCE TO CADMIUM,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 5A.
W80-02221

NIFURPIRINOL (FURANACE; P-7138) RELATED LESIONS ON CHANNEL CATFISH ICTALURUS PUNCTATUS (RAFINESQUE),
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
A. J. Mitchell, J. M. Grizzle, and J. A. Plumb.
Journal of Fish Diseases, Vol 1, p 115-121, 1978. 7 Fig, 13 Ref.

Descriptors: *Aquiculture, *Fish diseases, *Bioassay, *Toxicity, *Animal pathology, Fish physiology, Channel catfish, Ictalurus punctatus, Toxicant, Skin lesions, Nifurpirinol, Furanace P-7138, Fish chemotherapeutic, Muscle lesions, Gill lesions.

Skin lesions developed on channel catfish, Ictalurus punctatus, exposed to 0.5 mg/1 Furanace for 4 or 14 days. Lesions developed 3 days after the 4-day exposure and on the eleventh day of the 14-day exposure. The lesions continued to develop after the fish were moved to untreated water. The lesions which began as dull areas of skin, sometimes resulted in erosion of skin and muscle which exposed the vertebrae. Bacteria were not isolated from the lesions except those with severely eroded muscle. The gills possessed lesions characteristic of a response to a toxic chemical agent. (Katz-EIS).
W80-02222

RELATIONSHIP OF ENVIRONMENTAL PCO2 TO SELECTED BLOOD PARAMETERS OF ONCORHYNCHUS KISUTCH (WALBAUM),
Rhode Island Univ., Kingston. Dept. of Animal Science.
For primary bibliographic entry see Field 5A.
W80-02228

PHYSICAL AND CHEMICAL ASPECTS OF THE DISTRIBUTION OF POLYCHLORINATED BIPHENYLS IN THE AQUATIC ENVIRONMENT,
URS Co., Seattle, Wa.
For primary bibliographic entry see Field 5A.
W80-02229

DISTRIBUTION OF NITRATE AND RELATED NITROGEN SPECIES IN THE UNSATURATED ZONE, REDLANDS AND VICINITY, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-02233

WATER QUALITY IN THE PROPOSED PROSPERITY RESERVOIR AREA, CENTER CREEK BASIN, MISSOURI,
Geological Survey, Rolla, Mo. Water Resources Div.
For primary bibliographic entry see Field 4A.
W80-02234

TEST DATA FROM THE CHLORIDE-MONITOR WELL AT SUN CITY CENTER, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. C. Sinclair.
Geological Survey open-file report 78-1030, 1979. 20 p, 13 Fig, 7 Tab.

Descriptors: *Saline water-freshwater interfaces, *Water wells, *Test wells, *Monitoring, *Water quality, Chlorides, Water supply, Aquifer characteristics, Hydrogeology, Groundwater movement, Rock properties, Water analysis, Chemical analysis, Evaluation, *Sun City Center(Fla).

A test well drilled for Southwest Florida Water Management District at Sun City Center in Hillsborough County, will serve to monitor the interface between freshwater in the aquifer and the underlying chloride water. The sulfate content of the water in the aquifer at the well site exceeds 250 mg/L below a depth of about 700 feet. Wells for domestic and public supply in the area bottom at less than 500 feet and are separated from the sulfate water by about 100 feet of poorly-permeable limestone. The freshwater-chloride water interface is quite sharp and occurs at a depth of 1,410 feet. The chloride water is similar in composition to seawater but nearly twice as saline. (Woodard-USGS).
W80-02244

QUALITY OF SURFACE AND GROUND WATERS, YAKIMA INDIAN RESERVATION, WASHINGTON, 1973-74,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W80-02245

MERCURY IN SOUTHERN NEW ENGLAND COASTAL RAINS,
Connecticut Univ., Groton. Dept. of Geology and Geophysics.
T. R. Fogg, and W. F. Fitzgerald.
Journal of Geophysical Research, Vol 84, No C11, p 6987-6989, November 20, 1979. 2 Tab, 19 Ref. NSF GX33777.

Descriptors: *Mercury, *Rainfall, *Chemistry of precipitation, *New England, Sampling, Chemical analysis, Water chemistry, Pollutants, Pollutant identification, Path of pollutants, Precipitation(Atmospheric), Chemicals, Sodium, Coasts, Meteorology, Chemistry.

Mercury analyses were performed on 9 different rain samples collected from Connecticut and Cape Cod (Massachusetts) coastal locations. Concentrations of Hg averaged 10 + or - 5 ng/l for 29 determinations. Total washout of Hg from the atmosphere was not observed, suggesting that the quantity of Hg in rain may depend on the simple solution of various volatile species of Hg according to Henry's law. Existing global models use concentrations of 30-80 ng/l and appear to overestimate the rainfall Hg flux to the ocean. (Sim-ISWS)
W80-02326

MIXING OF BUOYANT SURFACE JET OVER SLOPING BOTTOM,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
B. Safaie.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 105, No WW4, Proceedings Paper 14954, p 357-373, November 1979. 13 Fig, 22 Ref, 3 Append.

Descriptors: *Jets, *Mixing, *Industrial wastes, *Beaches, Laboratory tests, Model studies, Mathematical models, Discharge(Water), Thermal pollution, Water pollution, Buoyancy, Dispersion, Shear, Coastal engineering, Environmental engineering, Hydraulics, Surface jets.

The mean characteristics of a buoyant surface jet discharged horizontally over sloping bottom was investigated through a set of systematic experiments. It was found that the mean characteristics of the buoyant surface jet do not vary monotonically with the source densimetric Froude number due to the formation of large-scale eddies and buoyant spread. An empirical relationship between normalized separation depth and source densimetric Froude number was presented, and a possible mechanism explaining the dynamics of the detachment point was suggested. A simple integral model was developed for the momentum-dominated region. The results of this model were used in conjunction with experimental results to show that the shape of similarity profile in the momentum-dominated region is a function of the bottom slope and discharge aspect ratio. (Sims-ISWS)
W80-02338

TWO-DIMENSIONAL BUOYANT JETS IN STRATIFIED FLUID,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
S. J. Wright, and R. B. Wallace.
Journal of the Hydraulics Division, Anerican Society of Civil Engineers, Vol 105, No HY11, Proceedings Paper 15003, p 1393-1406, November 1979. 4 Fig, 1 Tab, 8 Ref, 3 Append. NSF ENG78-05445.

Descriptors: *Jets, *Stratified flow, *Dispersion, *Sewage disposal, Oceans, Diffusion, Buoyancy, Stratification, Outfall sewers, laboratory tests, Hydraulic models, Model studies, Mathematical models, Equations, Coastal engineering, Hydraulics, Diffusers.

A two-dimensional byoyant jet discharged into a stratified fluid with no crossflow was considered. Two simple equations were developed which relate the maximum height of rise, Z sub m, to a stratification parameter and the jet-source flux of either momentum or buoyancy. Length scale analysis provided the form of the equations and determined the conditions when each equation applies. Coefficients, not provided by the length scale analysis, were estimated by integrating the integral equation of momentum from the origin to the point of zero mementum. Scale model tests verified the form of the equations for Z sub m and provided experimental values of the coefficients. (Sims-ISWS)
W80-02343

MULTIPLE JETS IN SHALLOW FLOWING RECEIVING WATERS,
Auburn Univ., AL. Dept. of Civil Engineering.
A. D. Parr, and W. W. Sayre.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY11, Proceedings Paper 14991, p 1357-1374, November 1979. 13 Fig, 2 Tab, 18 Ref, 2 Append.

Descriptors: *Jets, *Rivers, *Thermal pollution, Heated water, Powerplants, Mixing, Diffusion, Shallow water, laboratory tests, Model studies, Hydraulic models, Flumes, Water pollution, Hydraulics, Diffusers, Submerged jets.

An experimental study of multiple submerged heated jets discharging into confined, shallow, flowing receiving waters was conducted. Empirical relationships describing jet spreading and center line reduction of excess temperature and excess velocity near the source were developed. Comparisons between laboratory and field measurements were made for some of these relationships. A definition based on the experimental results was developed to predict the location where a row of submerged jets merge to form a two-dimensional slot jet. The results of the study should be of particular value in predicting the extent of cross-sectional mixing zones for submerged multiport diffusers in rivers. (Sims-ISWS)
W80-02344

COMPARISON OF VARIOUS METHODS OF SAMPLING SOIL WATER FOR DETERMINING IONIC SALTS, SODIUM, AND CALCIUM CONTENT IN SOIL COLUMNS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W80-02349

INFLUENCE OF WELL WATER QUALITY VARIABILITY ON SAMPLING DECISIONS AND MONITORING,
Science and Education Administration, Fresno, CA. Water Management Research.
H. I. Nightingale, and W. C. Bianchi.
Water Resources Bulletin, Vol 15, No 5, p 1394-1407, October 1979. 8 Fig, 2 Tab, 16 Ref.

Descriptors: *Groundwater, *Water quality, *Sampling, *Monitoring, *California, Wells, Water wells, Water chemistry, Variability, Risks, Statistics, Mathematical models, On-site investigations, Water pollution, Pollutants, *San Joaquin Valley (CA), Sample size, Sampling decisions.

Local governmental agencies responsible for decision in groundwater quality management need not only data on groundwater quality, but they also must understand the relationship of accuracies and risks associated with this data as related to the number of wells to sample. In this report this problem was addressed by using the philosophical doctrines of probabilism and relativism with simple statistical procedures. This requires a reasonable estimate of the population variance in quality parameter for a given management-unit area, and also requires that the decision maker formulate constraints with an acceptable standard error of the sample mean and be willing to accept some level of probability of being wrong. This technique was illustrated using a 21-year data base of well water chemical data in a 653 sq km groundwater quality study area in the San Joaquin Valley of California. (Sims-ISWS)
W80-02356

THE IMPORTANCE OF SOIL IN EVALUATING POTENTIAL WASTE WATER DISPOSAL SITES IN THE MISSOURI OZARKS,
Missouri Univ., Columbia. School of Forestry, Wildlife and Fisheries.
For primary bibliographic entry see Field 2G.
W80-02357

A STUDY OF THE PERSISTENCE OF SOME WATER-QUALITY PARAMETERS (ETUDE DE LA PERSISTANCE DE QUELQUES PARAMETRES DE QUALITE DE L'EAU),
Institut National de la Recherche Scientifique, Ri-

mouski (Quebec).
For primary bibliographic entry see Field 7C.
W80-02359

GOBIUS NIGER AS INDICATOR OF HGTOT MEAN CONCENTRATION IN THE MARINE ENVIRONMENT,
Parco Marino di Miramare, Trieste (Italy).
For primary bibliographic entry see Field 5A.
W80-02372

UTILIZATION OF CONCENTRATING ORGANISMS (MYTILUS GALLOPROVINCIALIS LMK) FOR THE SURVEY AND CONTROL OF MARINE POLLUTION,
Trieste Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5A.
W80-02374

FISH EGGS DIMENSIONS AND POLLUTION,
Athens Univ., (Greece). Dept. of Zoology.
A. Yannopoulos.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkee, p 461-463, 1979. 2 Fig, 1 Ref.

Descriptors: *Fish eggs, *Toxicity, *Nitrates, Nutrients, Size, Seasonal, Dimensions, Water temperature, Water pollution effects, Mode of action, Industrial wastes, Municipal wastes, *Sardina.

The most imprortant systematic characters of fish eggs, their dimensions, depend on various parameters, some already known, such as the period of the spawning season when egg deposition occurs, the age of the females, the temperature of the water and the different races of the same species. The present study gives evidence that heavy pollution, in the form of high concentrations of nitrates due to industrial and urban wastes, can affect the size of fish eggs, reducing them to below normal. It has not been defined if the presence of nitrates have a direct influence on the dimensions of fish eggs after their deposition or, what is more likely, an indirect one through the female ovaries. (Deal-EIS)
W80-02375

ON THE EFFECTS OF DDT ON ENZYME ACTIVITIES IN MUGIL CEPHALUS L.,
Institut za Oceanografiju i Ribarstvo, Split (Yugoslavia).
M. Tidor, and J. V. Bannister.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkee, p 445-447, 1979. 1 Tab.

Descriptors: *Enzymes, *Toxicity, *DDT, *Mullets, Inhibition, Animal metabolism, Fish physiology, Biochenmistry, Pesticide toxicity, Mode of action, Chemical analysis, Chlorinated hydrocarbon pesticides.

Some in vitro and in vivo observations on the DDT effects on activaties of enzymes from muscles and liver of Mugil cephalus L. were carried out. The in vitro tests showed a significant stimulating effect on lactate dehydrogenase from liver and fumarase from red muscles and liver. The white muscle lactate dehydrogenase showed reduced activity. The in vivo effects were quite different. Lactate dehydrogenase activity was inhibited in white and red muscle. An inhibitory effect was also found for succinate dehydrogenase and fumarase from all tissues. The cytochrome oxidase activity was extermely reduced. (Deal-EIS)
W80-02377

METALS IN THE MOLLUSCAN KIDNEY: A COMPARISON OF TWO CLOSELY RELATED BIVALVE SPECIES (ARGOPECTEN), USING X-RAY MICROANALYSIS AND ATOMIC ABSORPTION SPECTROSCOPY,
National Inst. of Environmental Health Science, Research Triangle Park, NC. Lab. of Environmental Toxicology.
N. G. Carmichael, K. S. Squibb, and B. A. Fowler.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 1149-1155, 1979. 5 Fig, 4 Tab, 17 Ref.

Descriptors: *Bioindicators, *Metals, *Molluska, Chemical analysis, Spectroscopy, Animal physiology, Animal metabolism, X-ray analysis, Path of pollutants, Calcium, Phosphorus, Manganese, Zinc, Cadmium, Copper, Chromium, Trace elements, *Scallop, *Argopecten, Kidney.

The kidney epithelial cells of Argopecten irradians contain concretions that occur within an apical vacuole in these cells and that have been analyzed in situ by energy dispersive X-ray microanalysis, Pellets of these concretions prepared from A. irradians and A. gibbus were compared by X-ray microanalysis and atomic absorption spectrophotometry; calcium and phosphorus were the major elements present in both species, but A. irradians contained higher amounts of magnesium and lower amounts of manganese and zinc than A. gibbus when expressed relative to calcium content. However, A. gibbus contained a smaller proportion of calcium by weight than A. irradians, and A. gibbus contained much higher levels of Cd, Cu, and Cr than A. irradians. The trace metal content of scallop kidney concretions may be a sensitive monitor of marine metal contamination provided that sufficient base line data are collected and individual, species, seasonal, and geographical variability are taken into account. (Deal-EIS)
W80-02383

ACCUMULATION OF COPPER IN CERTAIN BIVALVES OF VELLAR ESTUARY, PORTO NOVO, S. INDIA IN NATURAL AND EXPERIMENTAL CONDITIONS,
Annamalai Univ., Annamalainagar (India). Centre of Advanced Study in Marine Study.
For primary bibliographic entry see Field 5A.
W80-02390

THE OCCURRENCE OF COPPER, IRON AND ZINC IN THE HARD SHELL CLAM, MERCENARIA MERCENARIA, AND SEDIMENTS OF SOUTHAMPTON WATER,
Centeral Electricity Generating Board, Southampton (England). Marine Biological Lab.
M. G. Romeril.
Estuarine and Coastal Marine Science, Vol 9, p 423-434, 1979. 6 Fig, 4 Tab, 12 Ref.

Descriptors: *Metals, *Clams, *Absorption, *Copper, *Iron, *Zinc, Animal metabolism, Path of pollutants, Seasonal, Bottom sediments, Powerplants, Water pollution sources, Age, England, Southamption water, *Tissue analysis, *Bioaccumulation, *Depuration.

The concentration of copper, iron and zinc has been measured in hard shell clams, Mercenaria mercenaria, collected from several localities in Southampton Water to provide the background data necessary for the accurate assessment of the significance of observed fluctuations. The studies reveal considerable seasonal, age and geographical fluctuations in tissue metal concentrations. All metal concentrations in clam tissue are lower at the seaward end of the estuary, but although sediment metal levels generally follow a similar trend, tissue and sediment values appear to correlate with each other only for iron. There appears little evidence of any significant effect on metal uptake which could be attributable to the operation of Marchwood Power Station. (Deal-EIS)
W80-02391

LEAD IN SPOTTED WOLFISH, ANARHICHAS MINOR, NEAR A ZINC-LEAD MINE IN GREENLAND,
Copenhagen Univ. (Denmark). Inst. for Petrology.
H. J. Bollingberg, and P. Johansen.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1023-1028, 1979. 4 Fig, 3 Tab, 11 Ref.

Descriptors: *Lead, *Absorption, *Fish physiology, Growth stages, Mine wastes, Zinc, Chemical analysis, Arctic, Heavy metals, Bioindicators, Path of pollutants, Mussels, Public health, *Wolffish, *Anarhichas, *Tissue analysis, *Bioaccumulation, *Fucus, *Mytilus.

Lead concentrations in spotted wolffish (Anarhichas minor) collected from the vicinity of a sphalerite-galena mine and an ore concentration plant in West Greenland have been measured through a period of 2 yr before and 4 yr after mining operations started. Lead levels increased significantly since mining started, and accumulation takes place in liver and kiney, not in muscle tissue. The increased lead levels are not a risk to public health. Small fish have higher lead concentrations than larger ones. (Deal-EIS)
W80-02394

A DIRECT METHOD FOR STUDYING THE EFFECTS OF POLLUTANTS ON THE SEA BED,
J. M. Davies.
Scottish Fishery Bulletin, Vol 45, p 31-32, 1979.

Descriptors: *Waste disposal, *Toxicity, *Benthic fauna, Bottom sediments, Biological communities, Dominant organisms, Sludge disposal, Oil, Oil spills, Oil pollution, Methodology, Analytical techniques, On-site laboratories, *Species diversity.

At the present time the possibility of large scale irreversible contamination of the marine environment by the disposal of waste materials at sea is a controversial subject. The methodology employed in two experiments on the path and effects of pollutants on marine sediments are described. The first series of experiments tested the effects of dumping different doses of sewage sludge on two types of marine sediment. The goal is to determine an acceptable rate of sewage addition which will stimulate benthic production without leading to the drastic drop in diversity normally associated with heavy pollution. In a second series of experiments, the fate of weathered oil sunk onto the sea bottom is being investigated. Both experiments utilize six cylindrical tanks (open top and bottom) placed in the bottom sediments. Samples of the sediment inside the chambers are carried out by divers. Throughout the experiments the numbers and species of bottom living animals are recorded along with an estimate of the total community metabolism measured by oxygen uptake rate. The role of the sediment in recycling nutrients for primary production in the water column is also under investigation. (Deal-EIS)
W80-02398

CHEMICAL AND SUSPENDED-SEDIMENT CHARACTERISTICS OF RIVERS OF INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
For primary bibliographic entry see Field 2A.
W80-02400

5C. Effects Of Pollution

HISTORICAL, PHYSICAL, AND CHEMICAL LIMNOLOGY OF TWIN LAKES, COLORADO,
Engineering and Research Center, Denver, CO. Div. of General Research.
J. J. Sartoris, J. F. LaBounty, and H. D. Newkirk.
REC-ERC-77-13, September 1977. 86 p, 58 Fig, 11 Tab, 64 Ref.

Descriptors: *Limnology, *Trophic level, *Sediment-water interfaces, *Water chemistry, *Twin Lakes(CO), *Powerplants, *Environmental effects, Pumped storage, Stratification, Lakes, Colorado, Oxygen, Heavy metals, Water types, Limiting factors, Productivity, Phosphorus, Nutrients, Reduction(Chemical), Oxygen demand.

Upper Twin Lake, Colorado, is presently in trophic disequilibrium. Recently deposited allochthonous organic matter increases sediment oxygen demand so that water is highly reduced during long thermal stratification periods, releasing accu-

mulated iron and manganese quantities and in turn limiting phosphorus availability for primary production. This May 1971-1976 study of Twin Lakes, at Lake Creek, central Colorado, was initiated to obtain limnological data before constructing the Mt. Elbert Pumped-Storage powerplant. Twin Lakes are dimictic, montane, drainage lakes of glacial origin with soft, filute calcium carbonate waters. Heavy metals such as iron, manganese, zinc, copper and lead from naturally exposed mineral deposits are transported to Twin Lakes by Lake Creek. Upper lake secondary productivity is less than that of the lower lake. Upper lake oxygen minima are 6% saturation in winter and 45% in summer; lower lake oxygen minima average 26% in winter and 31% in summer. Upper lake oxygen variation is due to significant woody debris bottom deposits and Lake Creek's influence, flowing into bottom depths during summer stratification and absent in winter due to low flow. During prolonged winter oxygen depletion periods, reducing conditions develop at sediment-water interfaces, causing heavy metal diffusion into water columns. Heavy metals interfere with critical nutrient supplies, limiting phosphorus availability for primary production. (Danovich-Wisconsin)
W80-02049

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. LOWER COOK INLET INTERIM SYNTHESIS REPORT.
Science Applications, Inc., Boulder, CO.
For primary bibliographic entry see Field 5A.
W80-02053

EXISTING DISTRIBUTION AND CONCENTRATION OF POTENTIAL CONTAMINANTS ASSOCIATED WITH PETROLEUM DEVELOPMENT,
Science Applications Inc., Boulder, CO.
For primary bibliographic entry see Field 5B.
W80-02054

CONTAMINANTS AND ENVIRONMENTAL DISTURBANCES THAT MAY ACCOMPANY PETROLEUM EXPLORATION AND DEVELOPMENT,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
For primary bibliographic entry see Field 5B.
W80-02055

GEOLOGICAL HAZARDS TO PETROLEUM EXPLORATION AND DEVELOPMENT IN LOWER COOK INLET,
Science Applications, Inc., Boulder, CO.
For primary bibliographic entry see Field 5B.
W80-02056

TRANSPORT AND ALTERATION OF CONTAMINANT DISCHARGES,
Science Applications, Inc., Boulder CO.
For primary bibliographic entry see Field 5B.
W80-02057

BIOLOGICAL POPULATIONS AND ECOLOGICAL SYSTEMS,
Science Applications, Inc., Boulder, CO.
J. G. Strauch, Jr., E. G. Wolf, and K. W. Fucik.
In: Environmental Assessment of the Alaskan Continental Shelf, Lower Cook Inlet Interim Synthesis Report, p 105-196, July 1979. 106 Fig. NOAA/OCSEAP-03-7-022-35213.

Descriptors: *Resources development, *Aquatic life, *Water pollution effects, *Environmental effects, Ecosystems, Oil pollution, Baseline Studies, Alaska, *Outer Continental Shelf, Petroleum development, Cook Inlet(AK).

OCSEAP's underlying objective is the protection of the environment compatible with oil and gas development. Alaskan ecosystems have evolved over millions of years with minimal human influence. Some of the key considerations are: The offshore Inlet is nearly pollution-free and historically has experienced very little change in environmental conditions. For this reason many organisms may be unable to cope with sudden environmental changes. Because of the currents entering and leaving Cook Inlet, areas along the southern coast of the Alaska Peninsula and the Aleutian Islands would be affected by any major release of contaminants into the Inlet. Kachemak Bay is an important area for hatching and recruitment of fish and invertebrates; it is heavily used by migrant and wintering bird populations. Sea otters are a key species in determining community structure and they are particularly vulnerable to oil contamination. Because of complex food web interrelationships, oil spills affecting one species could affect organisms occupying other trophic levels. Petroleum hydrocarbons and heavy metals could accumulate in some sediments, leading to long-term exposure to benthic organisms. They can also be accumulated at least temporarily within the body tissues of most fish and invertebrates leading to the disruption of food webs. Cook Inlet supports an important fishery. There is a large potential for resource-conflict between the oil and gas industry and commercial and sports fisheries. Finally the Cook Inlet beluga whale population is probably isolated from other populations of the species and may be genetically distinct. It is unlikely that the population would be compensated by migrants from other areas. (See also W80-02053) (Sinha-OEIS)
W80-02058

A SYNTHESIS OF ENVIRONMENTAL INFORMATION CONCERNING POTENTIAL OCS OIL AND GAS DEVELOPMENT IN LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
For primary bibliographic entry see Field 5B.
W80-02059

EFFECT OF CRUDE OIL ON A LOUISIANA SPARTINA ALTERNIFLORA SALT MARSH,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. D. DeLaune, W. H. Patrick, Jr., and R. J. Buresh.
Environmental Pollution, Vol 20, No 1, p 21-31, September 1979. 1 Fig, 8 Tab, 18 Ref.

Descriptors: *Oil pollution, *Water pollution effects, *Environmental effects, Louisiana, Salt marshes, Grasses, Resources development, Wetlands, *Outer Continental Shelf, Crude oil, Spartina alterniflora.

The effect of Louisiana crude oil on growth of Spartina alterniflora Loisel and selected anaerobic soil processes in a Louisiana salt marsh was investigated. Greenhouse and field studies indicated that S. alterniflora can tolerate a large amount of oil without a short-term decrease in above-ground biomass. Neither the biological reduction of nitrate, manganese, iron and sulphate nor the production of methane and ammonium in stirred reduced sediments were affected by additions of up to 20% oil on a soil-weight basis. Oil placed on the water surface of unstirred sediment caused a release of iron, manganese and ammonium from the sediment to the overlying water due to the absence of oxygen in the water column. (Sinha-OEIS)
W80-02060

EMISSIONS FROM IN SITU BURNING OF CRUDE OIL IN THE ARCTIC,
Tornoto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
T. Day, D. MacKay, S. Nadeau, and R. Thurier.
Water, Air and Soil Pollution, Vol 11, No 2, p 139-152, February 1979. 5 Fig, 5 Tab, 22 Ref.

Descriptors: *Oil pollution, *Oil spills, Air pollution, *Water pollution, *Water quality control, *Arctic, *Burning, Dispersion, Environmental effects, Ice cover, Baseline studies, Resources development, *Outer Continental Shelf, In-situ burning, Crude oil, Beaufort Sea.

The results of an exploratory study of the effects of in situ crude oil spill burning on air quality in the Beaufort Sea region of the Arctic are presented. A scenario is postulated defining the amounts of oil released, the size and number of burnable oil pools, and the duration of the burning period. Estimates are made of the likely emission of soot, CO, SO2 and metals based on literature and some experimental work. Assumptions are made about plume rise and dispersion which permit downwind concentrations of emission to be calculated and compared with air quality objectives. Although the calculated concentrations may contain significant error because of the many assumptions, it is believed that the data demonstrate that concentrations of SO2 and CO will be acceptably low, concentrations of soot and metals will often be undesirably high within 10 km of the fires, but will be acceptably low at greater distances. It is concluded that burning may be a method of substantially reducing the adverse environmental impact of oil spills in the Arctic. (Sinha-OEIS)
W80-02061

A STUDY ON THE EFFECTS OF SALINITY AND TEMPERATURE ON THE DISAPPEARANCE OF AROMATIC HYDROCARBONS FROM THE WATER-SOLUBLE FRACTION OF NO. 2 FUEL OIL,
Texas A and M Univ., College Station. Dept. of Biology.
R. B. Laughlin, Jr., O. Linden, and J. M. Neff.
Chemosphere, Vol 8, No 10, p 741-749, 1979. 1 Fig, 2 Tab, 26 Ref.

Descriptors: *Water pollution effects, *Salinity, *Temperature, *Oil pollution, Testing, Baseline studies, Environmental effects, Resources development, *Outer Continental Shelf, *Aromatic hydrocarbons, Petroleum development, Fuel oil.

How temperature and salinity affect the rate of loss of aromatic hydrocarbons from seawater is discussed. The work was performed in connection with bioassays to examine the interactive effects of petroleum hydrocarbons and the dominant physical factors of salinity and temperature on marine organisms. An empirical approach is used to describe the loss of volatile aromatic hydrocarbons from a static bioassay solution. Using a statistical analysis, the half-time for these compounds in solution has been estimated. Temperature exerted a predominant effect on the loss, although high salinity may exert an interactive effect with temperature. In designing interactive bioassays to test the response of organisms to factorial combinations of petroleum hydrocarbons and physical environmental factors, preliminary experiments of this kind may prove to be extremely useful. They will allow a consistent exposure regime among different factor combinations and a complete enough characterization of exposure for comparison among experiments. (Sinha-OEIS)
W80-02062

THE ALASKAN OUTER CONTINENTAL SHELF ENVIRONMENTAL ASSESSMENT PROGRAM,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
R. J. Englemann.
Environmental Conservation, Vol 6, No 3, p 171-180, Autumn 1979. 2 Fig, 20 Ref.

Descriptors: *Resources development, *Environmental effects, *Alaska, *Water pollution effects, *Hazards, Oil pollution, Water quality, Cold regions, Transport, Baseline studies, Aquatic life, Water pollution sources, Sites, Leases, Coasts, *Outer Continental Shelf, *Environmental assessment, Petroleum development.

The Outer Continental Shelf Environmental Assessment Program (OCSEAP) is a multidisciplinary environmental study that is designed to provide timely inputs which are needed for decisions on off-shore oil and gas development. Approximately 100 projects in the Program address six tasks that are universal to environmental prediction and asessment. These include determination of pre-

development contamination, anticipation of future contaminants, transport of contaminants through the environment to receptors, location and character of biological populations, and the effects on organisms of expsoure to a contaminant. The sixth task identifies and characterizes the various physical hazards which the environment poses to human safety, installations, and oil and gas operations. (Sinha-OEIS)
W80-02064

SEWAGE CONTAMINATION IN THE NEW YORK BIGHT. COPROSTANOL AS AN INDICATOR,
National Oceanic and Atmospheric Administrarion, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5B.
W80-02065

AN ASSESSMENT OF THE POTENTIAL ENVIRONMENTAL IMPACT OF LARGE-SCALE SAND-DREDGING FOR THE BUILDING OF ARTIFICIAL ISLANDS IN THE NORTH SEA,
Rijksinstituut voor Visserijonderzoek, Ijmuiswn (Netherlands).
S. J. de Groot.
Ocean Management, Vol 5, No 3, p 211-232, October 1979. 4 Fig, 54 Ref.

Descriptors: *Dredging, *Water pollution effects, *Water quality, *Coasts, *Sands, Ecosystems, Fish, Benthos, Plankton, Mining, Resources development, Fisheries, *Outer Continental Shelf, *North Sea, Artificial islands, Environmental impact.

The building of artificial islands is contemplated in the coastal waters of the Netherlands. The potential environmental impact of a large-scale sand-dredging is evaluated. The most suitable mining methods, the effect on water quality-turbidity, the disturbance of the balance between bottom sediment and water column in relation to heavy metals, nutrients and PCB's are discussed, as well as the effect of dredging upon plankton, bottom fauna, fishes and on larvae and young stages of sea animals in general. The recovery time for the bottom fauna is estimated to be about three years. The consequences for the fisheries are mentioned, as the Netherlands coastal zone plays a very important role in the life of the North Sea species. This is related to the Dutch shrimp, plaice and sole fishery. An estimation of the yearly damage to the fisheries during the building phase is made. The building time for the island would be about 8 years. The island would cause damage to fisheries, in respect of a permanent loss of catches of Dfl. 10,000,000. (Sinha-OEIS)
W80-02068

SEDIMENT HYDROCARBONS NEAR AN OIL RIG,
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.
T. F. Lytle, and J. S. Lytle.
Estuarine and Coastal Marine Science, Vol 9, No 3, p 319-330, September 1979. 3 Fig, 5 Tab, 42 Ref.

Descriptors: *Sediments, *Oil pollution, *Water polluton effects, Texas, Environmental effects, Resources development, *Outer Continental Shelf, *Hydrocarbons, Oil rigs, Environmental impact, Petroleum development.

Sediment samples were collected from 25 strategic locations at a site on the Texas shelf before emplacement of an exploratory oil rig, during drilling and after the rig had been in place for 2 months. These sediments were analysed for aliphatic and aromatic hydrocarbons, and thirteen gas chromatogrphic parameters, used in assessing pollution, were calculated. Graphic cluster analysis, analysis of variance and discriminant analysis were applied to these paramters to view changes as well as to evaluate the effectiveness of gas chromatographic data in monitoring sediment hydrocarbons. Changes discernible by these techniques were slight but more noticeable at stations close to the rig. Hydrocarbons in the C14 to C20 region of the aliphatic chromatograms were in low abudnance in all samples but consisted mostly of n-C17 and C25 branched chain olefins. The high molecular weight region contained high concentrations of the odd carbon numbered n-alkanes with a predominance of n-C29. This similarity to terrestrial hydrocarbons was further confirmed by a mean delta C13 value vs. PDB of -28.0 o/oo for the aliphatic hydrocarbons. (Sinha-OEIS)
W80-02069

ONSHORE IMPACTS OF OFFSHORE OIL: A USER'S GUIDE TO ASSESSMENT METHODS,
D. C. Williams, and K. B. Hom.
Report prepared for U.S. Department of the Interior, Office of Policy Analysis, May 1979. 67 p, 27 Fig. DOI-14-01-0001-78-C-05.

Descriptors: *Resources development, *Planning, *Evaluation, Environmental effects, Water pollution, Shore protection, Baseline studies, *Outer Continental Shelf, Coastal Zone Management, Environmental impact.

This User's Guide describes three principal methodologies for assessing and planning for the onshore impacts of offshore oil: onshore facilities related to offshore oil and gas development; methodology for assessing onshore impacts of offshore outer continental shelf oil and gas development; and environmental planning for offshore oil and gas. The appropriate timing in the OCS process for study and planning, the criteria for approaching the methods, and the extent to which each covers important information needs are discussed. (Sinha-OEIS)
W80-02070

PROGRAMMATIC ENVIRONMENTAL IMPACT ASSESSMENT FOR OPERATIONAL OTEC PLATFORMS - A PROGRESS REPORT,
Interstate Electronics Corp., Anaheim, CA. Oceanic Engineering Div.
M. D. Sands.
In: 'Ocean Thermal Energy for the 80's, Preprints Volume 1, 6th OTEC Ocean Thermal Energy Conversion Conference, held in Washington, DC on June 19-22, 1979. DOE Conf-790631/1, p 65-5/1 - 6A-5/4, 1979. 1 Tab, 10 Ref.

Descriptors: *Energy conversion, *Environmental effects, *Resources development, Baseline studies, Sites, Offshore platforms, *Outer Continental Shelf, *Ocean Thermal Energy Conversion(OETC), Environmental impact.

As the Ocean Thermal Energy Conversion (OETC) Program advances toward commercialization, the potential environmental impacts of large-scale development must be assessed. Design modifications that will mitigate or reduce potentially adverse effects must be identified and incorporated into the design configurations. In the second phase of Interstate Electronics' OTEC Environmental Impact Assessment Program, the key issues associated with the deployment and operation of demonstration- and commercial-size plants are under evaluation. Presently, three platform design configurations are being considered: a 10 to 20 NWe land-based plant; an industrial plant-ship operation; and a 20 to 400 NWe moored plant. In the program, the land-based plants are to be located on tropical or subtropical islands, while the plant-ships would graze in the open ocean, producing ammonia, hydrogen, or other energy-intensive products. The moored platform will transmit electricity through a cable to a shore-based distribution point. In this assessment, both individual platforms and a mix of the above are being considered for potential siting in the thermal resource regions. Three categories of issues are: social, economic and institutional impacts, environmental impacts, and health and safety on and adjacent to the platforms. (Sinha-OEIS)
W80-02071

OTEC ENVIRONMENTAL AND RESOURCE ASSESSMENT PROGRAM,
Department of Energy, Washington, DC.
L. F. Lewis.
In: 'Ocean Thermal Energy for the 80's,' Preprints Volume 1, 6th OTEC Ocean Thermal Energy Conversion Conference, held in Washington, DC on June 19-22, 1979. DOE Conf-790631/1, p 6A-1/1 - 6A-1/4, 1979. 3 Fig 1 Tab, 19 Ref.

Descriptors: *Energy conversion, *Baseline studies, *Environmental effects, *Resources development, Sites, Water quality control, *Outer Continental Shelf, *Ocean Thermal Energy Conversion(OTEC).

The Ocean Thermal Energy Conversion (OTEC) Environmental and Resource Assessment Program is that part of the Department of Energy's activity which assesses the Environmental and Resource requirements for continued OTEC development and ensures not only that the appropriate research is done, but also that it matches the scheduled timeframe for development. The initial requirement is to locate possible OTEC sites not only by their available thermal resource and environmental response but also by other considerations such as their operational and survival design requirements. The program ensures that the information on conditions at the sites is acquired and that the best possible estimates of OTEC induced changes are made. The present program plan calls for a significant near term effort in site characterization at locations of probable OTEC deployment. This characterization is undertaken using historically acquired oceanographic data, models, hindcasts and othertechniques to the extent possible. Field measurements are made as necessary, to augment the archival data and, if required, for design and/or environmental assessment. Design requirements and site characterization data provide much of the necessary basis for environmental impact and resource assessments. (Sinha-OEIS)
W80-02072

ENVIRONMENTAL IMPACT ASSESSMENT FOR OTEC-1,
TRW Defense and Space Systems Group, Redondo Beach, CA.
For primary bibliographic entry see Field 5B.
W80-02073

OTEC PHYSICAL AND CLIMATIC ENVIRONMENTAL IMPACTS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 5B.
W80-02074

ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM AT POTENTIAL OTEC SITES,
California Univ., Berkeley. Lawrence Berkeley Lab.
P. Wilde.
In: Ocean Thermal Energy for the 80's, Preprints Volume II, 6th OTEC Ocean Thermal Energy Conversion Conference, held in Washington, DC on June 19-22, 1979. DOE CONF-790631/2, p 6A-4/1 - 6A-4/7, 1979. 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Energy conversion, *Environmental effects, *Resources development, Baseline studies, Monitoring, Water quality, Gulf of Mexico, Sites, Outer Continental Shelf, Ocean Thermal Energy Conversion(OTEC), Environmental impact.

Ecologically sound operations of projected Ocean Thermal Energy Conversion (OTEC) plants can be insured by careful attention to the marine environment during the design phase. This requires quality information from regions of potential OTEC interest, coordinated with required assessment studies to insure legal compliance. Currently preliminary or actual surveys and laboratory studies are being conducted in the waters of Puerto Rico, the Gulf of Mexico, Hawaii, and Guam for potential moored or seacoast OTEC plants and in the equatorial South Atlantic for proposed plant-ship operations to provide such benchmark and baseline data. These data plus existing archival information can be used to model effects of OTEC operations based on projected design schemes. Four major areas of concerns (1) redistribution of oceanic properties, (2) chemical pollution, (3)

structural effects, and (4) socio-legal-economic; and 11 key issues associated with OTEC deployment and operation have been identified. In general mitigating strategies can be used to alleviate many deleterious environment effects of operational problems as biostimulation, outgassing, etc. Various assessment research studies on toxicity, biocide releases, etc., are under way or are planned to investigate areas where no clear mitigating strategy is available. Data from the monitoring and assessment programs is being integrated into a series of environmental compliance documents including a comprehensive programmatic environmental impact assessment. (Sinha - OEIS)
W80-02075

METHODS OF UTILIZATION OF WASTE EFFLUENTS FROM MINERAL FERTILIZERS PLANTS IN CARP FRY CULTURES,
Wyzsza Szkola Rolnicza, Szczecin (Poland). Dept. of Hydrozoology.
For primary bibliographic entry see Field 5A.
W80-02078

EFFECT OF CRUDE OIL AND DETERGENT 'SOLO' ON THE ACTIVITY OF SOME HYDROLASES IN HEMOLYMPH OF CRAB RHITHROPANOPEUS HARRISI,
Medical Academy, Gdansk (Poland). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-02079

COMMUNITIES OF ORGANISMS DURING TREATMENT OF SEWAGE CONTAINING ANTIBIOTICS,
Panstwowy Zaklad Higieny, Warsaw (Poland). Dept. of Communal Hygiene.
J. Stanislawski.
Polskie Archiwum Hydrobiologii, Vol 26, No 1/2, p 221-229, 1979. 3 Fig, 11 Ref.

Descriptors: *Sewage effluents, *Trickling filters, *Biological communities, Biodegradation, Filters, Waste treatment, Bacteria, Algae, Protozoa, Dominant organisms, Toxicity, *Antibiotics, *Streptomycin, *Penicillin, *Oxytetracycline, *Chloramphenicol, *Tetracycline.

A study was made of the effect of antibiotics (streptomycin and a mixture of penicillin, oxytetracycline, chloramphenicol and tetracycline) on the communities of organisms forming the film in trickling filters during sewage purification. When present in amounts beginning from 10 mg/l of sewage, antibiotics reduce the numbers of organisms (mainly protozoans and invertebrates as well as bacteria and algae). Lower levels of antibiotics (less than 10 mg/l of sewage), occurring in hospital sewage, can also affect the development of the communities of organisms. During biological purification of this sewage, communities of organisms regenerate with time as a result of biochemical degradaton of sewage components. (Deal-EIS)
W80-02081

PHYSIOLOGICAL AND BEHAVIOURAL CHARACTERIZATION OF THE ACTION OF CHLORFENVINPHOS ON FISH LEBISTES RETICULATUS PETERS,
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergetics.
For primary bibliographic entry see Field 5B.
W80-02084

INFUENCE OF TEMPERATURE ON MORPHOLOGY AND PHYSIOLOGY OF SALMONID EMBRYOS, LARVAE AND ALEVINS,
Tikhookeanskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva i Okeanografii, Petropavlovsk-Kamchatskii (USSR).
For primary bibliographic entry see Field 5A.
W80-02085

PHOTOPERIODIC ACCLIMATION AND CIRCADIAN VARIATIONS IN TOLERANCE OF JUVENILE RANBOW TROUT (SALMO GAIRDNERI) TO ZINC,
British Columbia Research Council, Vancouver. Div. of Applied Biology.
For primary bibliographic entry see Field 5A.
W80-02087

DETECTION LIMITS OF A BIOLOGICAL MONITORING SYSTEM BASED ON FISH RESPIRATION,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands). Chemical Biological Div.
For primary bibliographic entry see Field 5A.
W80-02088

TOXICITY AND RETENTION OF DDT IN ADULT FROGS, RANA TEMPORARIA L.,
Kuopio Univ., (Finland).
For primary bibliographic entry see Field 5B.
W80-02090

EFFECTS OF A THERMAL DISCHARGE ON THE MORTALITY OF COPEPODS IN A SUBTROPICAL ESTUARY,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-02091

RESISTANCE OF MARINE GASTROPODS TO OXYGEN DEFICIENCY AND HYDROGEN SULPHIDE,
Sao Paulo Univ. (Brazil). Dept. de Fisiologia Geral.
K. Hiroki.
Boletim de Fisiologia Animal, Vol 2, p 33-42, 1978. 3 Fig, 4 Tab, 25 Ref.

Descriptors: *Oygen requirements, *Gastropods, *Hydrogen sulfide, Toxicity, Mortality, Sea water, Water chemistry, Resistance, Animal physiology, Animal metabolism, Animal behavior, *Littorina, *Neritina, *Olivella.

Many molluscs are known to be tolerant to oxygen deficiency. Laboratory experiments were carried out to obtain data on the resistance (LT50) of three gastropod species from the Brazilian coastal waters - Littorina ziczac, Neritina virginea and Olivella verreauxii in sea water poor in oxygen (ca. 0.2 ml/1) and/or hydrogen sulphide containing sea water (50 mg Na2S.9H2O/1). As a rule, the species were more resistant to oxygen deficiency than to the simultaneous presence of hydrogen sulphide. Neritina virginea was the most resistant species, under all experimental conditions, followed by Littorina ziczac and Olivella verreauxii. (Deal-EIS)
W80-02093

ADAPTATION OF A RECIRCULATING FISH CULTURE SYSTEM TO SALINITY CHANGE,
Biologische Anstalt Helgoland, Hamburg (Gemany, F.R.).
For primary bibliographic entry see Field 5A.
W80-02095

DEVELOPMENT OF ALGAE IN PONDS TREATED WITH FOSCHLOR AND IN PONDS WITH CONTROLLED TIME OF FILL,
Instytut Rybactwa Srodladowego, Zibieniec (Poland). Pond and River Dept.
For primary bibliographic entry see Field 5A.
W80-02096

EFFECT OF COPPER SULFATE AND SODIUM PENTACHLOROPHENATE ON ADENINE AND ADENOSINE PHOSPHATES IN LYMNAEA LUTEOLA (MOLLUSCA: GASTROPODA),
Sri Venkateswara Univ., Tirupati, (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02097

THE INFLUENCE OF AMMONIA WATER ON BACTERIA, PLANKTON AND BOTTOM FAUNA OF PONDS, (IN POLISH),
Instytut Rybactwa Srodiadowego. Warsaw (Poland).
For primary bibliographic entry see Field 5A.
W80-02099

CHANGES IN THE ICHTHYOFAUNA OF LAKE ZIOLO AS AN INDEX OF PROGRESSING EUTROPHICATION (IN POLISH),
Akademia Rolniczo-Techniczna, Olssztyn-Lortowo (Poland). Inst. of Hydrobiology and Water Conservation.
S. Dudzinski.
Roczniki Nauk Rolniczych, Vol 99, No 1, p 81-96, 1978. 7 Fig, 1 Tab, 23 Ref.

Descriptors: *Eutrophication, *Fishkill, *Fish populations, Toxicity, Mortality, Lakes, Rivers, Sewage effluents, Nutrients, Oxygen sag, Benthic fauna, Eels, Commercial fish, Perches, Pikes, Seasonal, Spawning, Poland, Welna River, Struga Gnieznienska River.

Excessive amounts of wastes introduced in to the rivers Welna and Struga Gnieznienska resulted in eliminating from fishery production lakes situated on their course. These lakes practically play the role of sedimentation tanks. Lack of decisive remedial measures resulted in a total degradation of Lake Ziolo--the first of the Rogowskie Lakes Complex. In the first period introduction of wastes had a beneficial effect increasing the fertility of the lake and its productivity. Further 'fertilization' resulted in oxygen deficits during winter due to the composition of organic matter, and in mass fish kills (first kill was noted in winter 1961). A drastic drop in the production of valuable fish species was noted, so that practically these species disappeared from the lake. Eel was the first to react to unfavourable conditions (in 1957). This species inhabits bottom zone of lakes, buried in the mud, and hence it is most strongly exposed to oxygen deficits. Pike was eliminated from the lake almost simultaneously with eel (in 1959). Decrease of water transparency, caused by the development of phytoplankton, reduced visibility and resulted in unfavourable feeding conditions for pike, and also in reducing its ability to avoid fishing gear. (Deal-EIS)
W80-02100

AN EVALUATION OF THE USEFULNESS OF A POND ENVIRONMENT WITH HEATED WATER FOR REARING OF FISH,
Instytut Rybactwa Srodladowego, Warsaw (Poland).
For primary bibliographic entry see Field 5A.
W80-02101

AN ATTEMPT TO DISINFECT FISH PONDS WITH AMMONIA WATER (IN POLISH),
Instytut Rybactwa Srodladowego, Warsaw (Poland).
For primary bibliographic entry see Field 5A.
W80-02103

THE SENSITIVITY OF FISH EMBRYOS TO THE EFFECT OF TOXICANTS,
Moscow State Univ. (USSR). Special Topics Lab.
For primary bibliographic entry see Field 5A.
W80-02104

AN ASSESSMENT OF KNOWLEDGE CONCERNING THE FATE AND EFFECTS OF PETROLEUM HYDROCARBONS IN THE MARINE ENVIRONMENT,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
For primary bibliographic entry see Field 5A.
W80-02107

PESTICIDES: THEIR IMPACT ON THE ESTUARINE ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-02109

MULTIPLE FACTOR INTERACTIONS AND STRESS IN COASTAL SYSTEMS: A REVIEW

OF EXPERIMENTAL APPROACHES AND FIELD IMPLICATIONS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
For primary bibliographic entry see Field 5A.
W80-02111

TEST OF A MODEL FOR PREDICTING KEPONE ACCUMULATION IN SELECTED ESTUARINE SPECIES,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-02113

BIOCONCENTRATION AND METABOLISM OF LINEAR ALKYLBENZENE SULFONATE BY DAPHNIDS AND FATHEAD MINNOWS,
Monsanto Co., St. Louis, MO.
R. M. Comotto, R. A. Kimerle, and R. D. Swisher.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 232-250, 1979. 8 Fig, 4 Tab, 28 Ref.

Descriptors: *Alkylbenzene sulfonates, *Daphnia, *Minnows, Biodegradation, Animal metabolism, Surfactants, Tracers, Absorption, Carbon radioisotopes, Gas chromatography, Path of pollutants, *Bioconcentration, *Tissue analysis.

The bioconcentration potential of the anionic surfactant linear alkylbenzene sulfonate (LAS) was studied using daphnids (Daphnia magna) and fathead minnows (Pimephales promelas) in studies extending up to 50 days. Uptake in the test organisms, as measured by 14C activity, was a function of chain length and exposure concentration. In whole organisms, the dry weight bioconcentration factors (BCF) were 500 to 4000 for daphnids and 200 to 2000 for fathead minnows. In fish tissues, the greatest 14C activity occurred in the gall bladder, the BCFs ranging from 20,000 to 70,000, while the least occurred in the muscle, the BCFs remaining in the range of 100 to 400. In depuration studies, greater than 85 percent of the 14C content was cleared from all tissues within three to four days, with nearly 100 percent clearance within ten days. The results of desulfonation/gas chromatography analyses of tissues suggested that the fathead minnows metabolised LAS, and the daphnids did not. From the present studies and from previously reported toxicity and microbial biodegradation studies, it can be further concluded that under environmental conditions there is little likelihood that LAS bioconcentration creates a hazard to aquatic ecosystems. (Deal-EIS)
W80-02114

AN APPROACH TO THE TOXICOLOGICAL EVALUATION OF A COMPLEX INDUSTRIAL WASTEWATER,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5A.
W80-02117

ORGANOCHLORINE CONTAMINANTS AND TRENDS IN REPRODUCTION IN GREAT LAKES HERRING GULLS, 1974-1978,
Department of Fisheries and Environment, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W80-02123

CHANGES IN SPECIES COMPOSITION OF GREAT LAKES FISH COMMUNITIES CAUSED BY MAN,
Toronto Univ.(Ontario). Inst. for Environmental Studies.
H. A. Regier.
Transactions of the Forty-fourth North American Wildlife and Natural Resources Conference, p 558-566, 1979. K. Sabol, Ed., 15 Ref.

Descriptors: *Great Lakes, *Fish management, *Water quality control, Commercial fishing, Fish populations, Dominant organisms, Water pollution effects, Benthic flora, Benthic fauna, Biological communities, Eutrophication, Industrial wastes, Chemical wastes, Channel improvement, Ecosystems, Water quality, Water quality standards, *Species diversity.

Overall the change in the fish associations in the Great Lakes during the past two centuries has involved a massive shift from high-valued, large, long-lived, benthic species to low valued, small, short-lived pelagic species. Though fishery enterprises, both commercial and sport, have found ways to use some of the species that are currently dominant, a return to the earlier association is generally held to be a desirable goal on economic grounds. But what the relative economic benefits would be has not yet been fully assessed. The long list of stressful human activities presented have often interacted additively or even synergistically to effect the overall transformation of the fish association. It helps to explain why all the piecemeal and uncoordinated attempts to 'manage' the Great Lakes fisheries heretofore have been relatively ineffective. Presumably a similar reason underlies the lack of significant progress in the Great Lakes cleanup program, where qualities other than the relative value of fish stocks are of primary consideration. (Deal-EIS)
W80-02124

CRITICAL FACTORS IN THE TRANSPORT OF LIVE FRESHWATER FISH--II. STATE OF FEEDING AND AMMONIA EXCRETION,
Ministry of Agriculture, Fisheries and Food, London (England). Salmon and Freshwater Fisheries Lab.
For primary bibliographic entry see Field 5A.
W80-02126

NUTRIENT BUDGETS AND THE EFFECTS OF DEVELOPMENT ON TROPHIC CONDITIONS IN LAKES,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical and Environmental Engineering.
D. B. Aulenbach.
Rensselaer Fresh Water Institute Report 79-2, 1979. 34 p, 6 Fig, 8 Tab, 19 Ref.

Descriptors: *Saratoga Lake(NY), *Eutrophication, *Lake George(NY), *Sewage treatment, *Trophic level, *Land development, Lakes, Water pollution sources, Nutrients, Urban runoff, Urbanization, Land use, Sewage disposal, Treatment facilities, Oligotrophy, Construction, Sewage districts, Sewerage, Water quality, Water policy, Planning.

Massive funding of U.S. wastewater treatment systems may not result in pristine lakes; efforts may improve water quality in some lakes, while in other instances, ensuing development allowed by treatment plant and sewer construction may actually cause additional eutrophication. Sewage treatment construction impacts were evaluated for Saratoga Lake and Lake George, eastern New York. Although they are only 40 km apart, Saratoga Lake is highly eutrophic whereas Lake George is oligotrophic to mesotrophic. Saratoga Lake has 15.6 sq km surface area, 544 sq km drainage area, 8 m average depth, and 130 day hydraulic detention time. Lake George has 114 sq km surface area, 492 sq km drainage area, 18 m average depth, and 8.0 year hydraulic detention time. Saratoga Lake has 28,942 kg/yr total phosphorus (P) load and 340,357 kg/yr total nitrogen (N) load compared with 13,096 kg P/yr and 197,420 kg N/yr for Lake George. Largest nutrient loads for both lakes are from non-point sources. Sewage treatment plant construction plans were drawn up for both lakes; the plans would divert all direct discharges from the lakes. Construction definitely reduces Saratoga nutrient loading; however, not enough to bring it out of eutrophic range. Sewage treatment plant construction in Lake George with ensuing allowable development and would actually increase loads due to high P concentrations in urban runoff. Therefore, treatment facility construction should include plans preventing additional P loadings due to development and urban runoff. (Danovich-Wisconsin
W80-02127

STUDIES OF CARBON AND NITROGEN METABOLISM BY THREE MARINE PHYTOPLANKTON SPECIES IN NITRATE-LIMITED CONTINUOUS CULTURE,
Hawaii Univ., Honolulu. Dept. of Oceanography.
E. A. Laws, and D. C. L. Wong.
Journal of Phycology, Vol 14, No 4, p 406-416, 1978. 5 Fig, 3 Tab, 33 Ref. NSF DES75-20844, EPA R800906.

Descriptors: *Metabolism, *Nutrient kinetics, *Phytoplankton, *Carbon, *Nitrogen, *Laboratory tests, Chlorophyll, Cultures, Plant growth, Growth rates, Nitrates, Diatoms, Respiration, Productivity, Kinetics, Organic matter, Chlorophyta, Michaelis-Menten equations, Nutrients, Nutrient requirements.

Thalassiosira allenii cultures show 0.1-0.2 ratio of dark carbon (C) loss to daytime net C production over 0.005-0.06/h growth rate range. For Monochrysis lutheri and Dunaliella tertiolecta, the loss/production ratio is 0.2-0.3 with 0.005-0.025/h growth rates; however, the latter ratio declines at higher growth rates when dark nitrate uptake cell capacity exceeds pumping rates. Lower C production efficiency of M. lutheri and D. tertiolecta vs. T. allenii helps explain why the first two species are largely confined to tidal pool environments, where resistance to fluctuations in temperature and salinity enables them to survive, but are rarely found in offshore waters where they must compete with more efficient C-producing species. The study observes C and Nitrogen (N) metabolism of marine phytoplankton, grown on light/dark cycles in continuous flow systems at different growth rates. Populations are uniformly labeled with C14 to facilitate C production, respiration, and excretion studies. C excretion rates are quite low compared to respiration rates, averaging 1% of daytime net production for T. allenii and M. lutheri and 1.4% for D. tertiolecta. Productivity indices do not correlate with growth rate due to significant positive correlation between chlorophyll-a:C ratios and growth rate. Dark nitrate maximum uptake rates (V-max) for M. lutheri, D. tertiolecta and T. allenii average 23%, 64%, and 120% respectively, of light nitrate V-max. Diurnal periodicity in V-max for T. allenii is partially due to changes in enzyme activity. (Danovich-Wisconsin)
W80-02128

HYDROLOGICAL STRUCTURE ANALYSIS FOR ESTIMATING THE PRIMARY PRODUCTION IN THE TROPICAL ATLANTIC OCEAN,
Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (Ivory Coast). Centre de Recherches Oceanographiques.
A. Herbland, and B. Voituriez.
Journal of Marine Research, Vol 37, No 1, p 87-101, 1979. 10 Fig, 1 Tab, 21 Ref.

Descriptors: *Chlorophyll, *Primary productivity, *Atlantic Ocean, *Tropical regions, *Nitrates, *Environmental gradient, *Phytoplankton, *Biomass, Oxygen, Light, Light intensity, Epilimnion, Thermocline, Stratification, Regression analysis, Correlation analysis, Equations, Photosynthesis, Africa, Nutrients.

Hydrologic structure analysis in tropical Atlantic Ocean eutrophic layers facilitates rough phytoplankton biomass and production estimates in the water column from any vertical nitrate, nitrite, fluorescence, oxygen, and temperature profiles. The paper describes relationships defining chlorophyll and primary production profiles taken from data by R.V. Capricorne in five cruises off Africa 1973-1977. Chlorophyll profiles show a regular deep maximum near the bottom of the mixed layer; values range 0.05-0.15 micro g/l in mixed layers and can reach 1 micro g/l. The top of the nitracline (nitrate gradient) is associated with the chlorophyll maximum. Maximum chlorophyll depth and maximal photosynthetic activity depths are statistically equal, giving evidence of the importance of nitracline which is the best lighted nutrient-rich layer in the water column. When the nitrate-depleted layer is deep (60 m), primary production maximum is undetectable. Stability limits the degree of vertical mixing and, therefore, controls nitracline depth. When vertical advection is

negligible, nitracline and thermal maximum gradient (TMG) depths are related. The top of the nitracline stands below the TMG when it is close to the surface. When the TMG is deep, the top of the nitracline stands above the TMG. The nitrate primary maximum is located 10-12 m below the top of the nitracline in decreasing chlorophyll concentrations where light limits primary production. It defines the bottom of the euphotic layer. (Danovich-Wisconsin)
W80-02129

THE EFFECT OF SEWAGE SPRAY IRRIGATION ON DISEASE VECTORS - JULY 1975 - DECEMBER 1978,
Michigan State Univ., East Lansing, Dept. of Entomology.
For primary bibliographic entry see Field 3C.
W80-02156

STRESS AND CHRONIC EFFECTS OF UNTREATED AND TREATED BLEACHED KRAFT PULPMILL EFFLUENT ON THE BIOCHEMISTRY AND STAMINA OF JUVENILE COHO SALMON (ONCORHYNCHUS KISUTCH),
British Columbia Research Council, Vancouver. Div. of Applied Biology.
For primary bibliographic entry see Field 5B.
W80-02211

CHLORINATED PARAFFINS-AN ENVIRONMENTAL HAZARD,
National Swedish Environment Protection Board, Studsvik. Brackish Water Toxicology Lab.
For primary bibliographic entry see Field 5A.
W80-02214

MERCURY IN WATER AND FISH FROM THE SAO VINCENTE ESTUARY NEAR SANTOS, BRAZIL,
Instituto de Pesca, Santos (Brazil). Coordenadoria de Pesquisa de Recursos Naturais,
For primary bibliographic entry see Field 5A.
W80-02215

RESPONSES TO SALINITY IN LARVAE FROM THREE LOCAL POPULATIONS OF THE FRESHWATER SHRIMP, MACROBRACHIUM NIPPONENSE,
Tokyo Univ. of Fisheries (Japan). Fisheries Resources Research Lab.
For primary bibliographic entry see Field 5A.
W80-02216

NIFURPIRINOL (FURANACE; P-7138) RELATED LESIONS ON CHANNEL CATFISH ICTALURUS PUNCTATUS (RAFINESQUE),
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 5B.
W80-02222

POISONING OF WILD BIRDS BY ORGANOPHOSPHATE AND CARBAMATE PESTICIDES,
New York State Dept. of Environmental Conservation, Albany.
W. B. Stone.
New York Fish & Game Journal, Vol 26, No 1, p 37-47, 1979. 1 Fig, 7 Ref.

Descriptors: *Pesticides, *Insecticides, *Waterfowl, Organophosphorous pesticides, *Mammals, *Industrial wastes, Carbofuran, Bioassay, On-site-investigation, Mallards, Canada geese, Frogs, Mergansers, Aquatic insects, Ducks, Woodchuck, Raccoons, Skunks.

Eight instances are reported in which organophosphate or carbamate (cholinesterase inhibitor) pesticides applied for various purposes killed wild birds. It is believed that thousands of birds are being killed in this way, and more such cases are anticipated because of the widespread use, and often misuse, of these pesticides. Methods are suggested for investigating wildlife poisonings of this sort. Recorded are cases of water fowl killed in lawns, Canada geese killed on golf courses and birds killed at industrial lagoons. The lagoon was contaminated by carbofuran. The waters were toxic not only to birds, but to fish, aquatic insects, and mammals including woodchucks, raccoons, and skunks. (Katz-EIS).
W80-02223

SOME STUDIES ON THE HEPATIC MICROSOMAL ENZYME ACTIVITIES AND STEROID HORMONE LEVELS IN CARP, CYPRINUS CARPIO EXPOSED FOR SIX MONTHS,
London Univ. (England).
For primary bibliographic entry see Field 5A.
W80-02225

EFFECTS OF TEMPERATURE AND STOCKING DENSITY ON FOOD CONSUMPTION AND GROWTH OF GRASS CARP CTENOPHARYNGODON IDELLA, VAL.,
Arkansas Univ., Fayetteville. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02226

INFLUENCE OF SOCIAL RANK ON THE BEHAVIOUR OF BLUEGILL, LEPOMIS MACROCHIRUS RAFINESQUE EXPOSED TO SUBLETHAL CONCENTRATIONS OF CADMIUM AND ZINC,
Iowa State Univ., Ames. Dept. of Animal Ecology.
M. G. Henry, and G. J. Atchison.
Journal of Fish Biology, Vol 15, p 309-315, 1979. 2 Tab, 31 Ref.

Descriptors: *Fish behavior, *Toxicity, *Heavy metals, *Cadmium, *Zinc, Sunfishes, Mode of action, Social behavior(Animal), Animal behavior, Fish physiology, Fish populations, *Social rank, *Hierarchy.

The influence of social rank on changes in Lepomis macrochirus behaviour brought about by exposure to sublethal concentrations of cadmium and zinc was studied. Significant changes occurred in the frequency of eight of the nine behavioural acts quantified. The effects of metals on the behaviour of individuals was often related to the individual's social status in the hierarchies that had formed. The majority of agonistic behaviours (nips and nudges) were performed by dominant individuals and the majority of comfort behaviours (coughs, yawns, jerks, jerk swimming, fin flickering and chafes) occurred in subordinate individuals. These differences occurred during the control period as well as the treatment period and are thought to be in part caused by socially induced stress. (Deal-EIS).
W80-02227

STUDY OF THE EFFECTS OF MINING AND MILLING OPERATIONS ON HIGH MOUNTAIN STREAMS,
Colorado Dept. of Natural Resources, Fort Collins. Div. of Wildlife.
For primary bibliographic entry see Field 5A.
W80-02250

STUDY OF THE EFFECTS OF METALIC IONS ON FISH AND AQUATIC ORGANISMS,
Colorado Dept. of Natural Resources, Fort Collins. Div. of Wildlife.
For primary bibliographic entry see Field 5A.
W80-02251

KINETICS OF NITROGEN-LIMITED ALGAL GROWTH,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
N. Nyholm.
Progress in Water Technology, Vol 8, No 4-5, p 347-358, 1977. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Kinetics, *Nitrogen, *Limiting factors, *Growth rates, *Cycling nutrients, Mathematical models, Algae, Phytoplankton, Nutrients, Cytological studies, Biochemistry.

The specific growth rate of nitrogen-limited cells is a linear function of intracellular nitrogen concentration expressed as total cellular nitrogen per cell dryweight. When nitrogen is no longer limiting, cells adjust their uptake rate and incorporate nitrogen in proportion to growth. Specific intracellular nitrogen content is a dynamic quantity which controls growth rate. Seven sets of data from continuos culture studies were taken from the literature. The Nyholm model, previously used to describe growth of phosphorus-limited algae, was applied to nitrogen-limited growth with first-order reaction kinetics. The purpose of this research was to study the relationship between algal growth rate and the supply of limiting nutrients. It includes intracellular nitrogen content as a state variable and assumes that when nitrogen is limiting, all available nitrogen is incorporated into the cells (therefore, eliminating the need for uptake kinetics). When nitrogen is present in excess, uptake is proportional to growth. The intracellular nitrogen was divided into two fractions: a structural substrate which equals the total substrate content when the growth rate is zero, and a residual or active substrate which converts to structural nitrogen in proportion to growth. Batch and chemostat experiments were simulated. The biomass was expressed as carbon in four sets of data and dryweight in the others. (Danovich-Wisconsin).
W80-02252

THE EFFECTS OF A COAL FIRED POWER PLANT ON WETLANDS,
Indiana Univ. at Bloomington. School of Public and Environmental Affairs.
D. E. Willard.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 37-44, 1978. 7 Fig.

Descriptors: *Wetlands, *Power plants, *Thermal pollution, *Environmental effects, Freshwater marshes, Vegetation effects, Marshes, Birds, Fish, Water level fluctuations, Wisconsin.

The physical impacts to the wetlands adjacent to the Columbia River Power Plant near Portage, Wisconsin, are similar to those caused by highway, subdivision, or water control device construction. The thermal pollution is specific. These impacts acting together cause an increase in water level, a reduction of annual fluctuation, and anachronistic warming. The effect of the resultant change in vegetation on fish and bird species composition has not yet been determined. (See also W80-02253) (Howard-Mass).
W80-02259

SAN FRANCISCO BAY: THE WETLANDS BESEIGED,
For primary bibliographic entry see Field 6G.
W80-02278

THE ENVIRONMENTAL FATE OF THREE DICHLOROPHENYL NITROPHENYL ETHER HERBICIDES IN A RICE PADDY MODEL ECOSYSTEM,
Illinois Univ. at Urbana-Champaign. Dept. of Entomology.
A. H. Lee, P. Y. Lu, R. L. Metcalf, and E. L. Hsu.
Journal of Environmental Quality, Vol 5, No 4, p 482-486, October-December, 1976. 2 Fig, 4 Tab, 23 Ref.

Descriptors: *Wetlands, *Rice, *Herbicides, *Environmental effects, *Model studies, Rooted aquatic plants, Toxicity, Degradation, Ecology, Ecological distribution, Ecosystems.

Of three carbon-14 radiolabeled diphenyl ether herbicides, tissue storage of bifenox was minimal under laboratory rice paddy model ecosystem conditions. The carbomethoxy group of this compound served as an effective degradophore. Nitrofen and methoxy-nitrofen were relatively stable and were bioconcentrated and stored over a 33-day period in tissues of algae, snail, mosquito, and fish. Nitrofen showed high toxicity to rice plants. Methoxy-nitrofen and bifenox did not affect the rice but were toxic to algae. (Howard-Mass)

W80-02301

PERSISTENCE AND FACTORS AFFECTING DISSIPATION OF MOLINATE UNDER FLOODED RICE CULTURE,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
L. E. Deuel, F. T. Turner, K. W. Brown, and J. D. Price.
Journal of Environmental Quality, Vol 7, No 3, p 373-377, July-September, 1978. 2 Fig, 5 Tab, 7 Ref.

Descriptors: *Wetlands, *Rice, *Pesticides, *Environmental effects, Persistence, Degradation(Decomposition), Agriculture, Rooted aquatic plants, Ecology.

Pesticides, essential for the economical production of rice (Oryza sativa L.), could pose a serious problem if transported to surface impoundments and estuaries along the Gulf Coast via the return flow associated with flooded rice culture. Field experiments were conducted under flooded rice cultivation to determine persistence and half-life of molinate (S-ethyl-hexahydro-1-H-azepine-1-carbothioate). Persistence and half-life were evaluated with respect to intermittent and continuous flow irrigation schemes at normal and excessive application rates of 3.4 and 11.2 kg/ha molinate, respectively. Persistence at statistically significant levels ranged from 96 to 384 hours following the application, and generally was more a function of the application rate than irrigation scheme. Half-life values averaged 96 + 22 hours in intermittent flow plots, and 54 + 17 hours in continuous flow plots over the 3-year experiment. Application rate had little effect on half-life. Best fit analysis of field data to the first order biological decay equation and laboratory studies under flooded soil conditions suggested that biological degradation was the principle mode by which molinate was dissipated in the field experiment. (Howard-Mass)
W80-02302

COMBINED ACTION OF POLYPHENOILS, QUINONES, REDUCERS AND CERTAIN OTHER COMPOUNDS ON AQUATIC PLANTS,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
For primary bibliographic entry see Field 5F.
W80-02331

LINKAGES BETWEEN THE ECONOMY AND THE ENVIRONMENT OF THE COASTAL ZONE OF MISSISSIPPI. PART II: ENVIRONMENTAL MODEL.
University of Southern Mississippi, Hattiesburg. Bureau of Business Research.
E. Nissan, D. C. Williams, Jr., and T. Green.
Mississippi-Alabama Sea Grant Consortium Report No MASGP-78-041, Interim Technical Report, June 1979. 150 p, 10 Tab, 53 Ref, 2 Append.

Descriptors: *Economy, *Coasts, *Environments, *Models, Pollutants, Air pollution, Water pollution, Mississippi, Alabama, Coastal zone, Solid waste pollution, Sea Grant program.

This report is the middle link of three projects and its purpose is to determine the physical magnitudes of air, water and solid waste pollution generated through the economic activities of the coastal region of Mississippi. This is necessary for the subsequent stage where the linkage between the economic and environmental parts will be undertaken. Water effluent information gathered in this report was based primarily upon actual data provided by the Mississippi Air and Water Pollution Control Commission obtained as part of their monitoring of producing establishments. Other vehicles for collecting data had to be used such as secondary sources. Some information was collected by personal contacts with engineers and experts in this field. (NOAA)
W80-02367

STUDY OF THE MORTALITY OF ZOOPLANKTON PASSING THROUGH THE COOLING WATER SYSTEM OF A THERMOELECTRIC POWERPLANT, (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
R. Gaudy, and B. Moatti.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco. 24-27 Novembre 1978, Antalya, Turkee, p 399-403, 1979. 2 Fig, 12 Ref. (English Summary).

Descriptors: *Mortality, *Zooplankton, *Entrainment, Powerplants, Cooling waters, Sampling, Analytical techniques, Methodology, Thermal stress, Heated water, Chlorination, Turbulence, Water circulation, France, Gulf of Fos.

The mortality of zooplankton sampled from intake and effluent circuits of a power plant (Martigues-Ponteau, Gulf of Fos, France) has been followed during a 18 months study. A vital staining technic was used to determine the proportion of dead and live animals under different conditions of the central activity. The sampling process, adding with the natural mortality caused a mortality rate of 25%. The lethal factors introduced by the cooling water system were the turbulence (mechanical shock in the circuits):21%-the thermal shock, whose the effect is correlated with the increase of delta t (about 0 to 12%)-the chlorination (31% as an average). The mortality appeared to affect in the same way larger and smaller forms of zooplankton. These results are discussed and compared with previous estimations. (Deal-EIS)
W80-02370

ZOOPLANKTON COMMUNITIES OF THE NW ADRIATIC INSHORE WATERS NEAR DUBROVNIK,
Biological Inst. Dubrovnik (Yugoslavia).
A. Benovic, T. Gamulin, J. Hure, F. Krsinic, and B. Skaramuca.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkee, p 391-398, 1979. 4 Fig, 1 Tab, 3 Ref.

Descriptors: *Zooplankton, *Biological communities, *Baseline studies, Seasonal, Domestic wastes, Dominant organisms, Growth stages, Copepods, Biomass, Crustaceans, Water circulation, *Yugoslovia, *Adriatic Sea, Dubrovnik.

As a part of the coordinated FAO (GFCM) UNEP MED-V Pilot Project, research has been undertaken on marine zooplankton communities in the Dubrovnik area (Yugoslavia). The station grid covers the NW part of Dubrovnik, an area characterized by the polluted harbour of Gruz, the mouth of the Dubrovacka river, and an island area influenced by deep Southern Adriatic currents. Microzooplankton as well as net-zooplankton data indicate winter inflow of the offshore waters and rather minimal influx of fresh and polluted water from the river mouth and the city harbour in the summertime. It was possible to trace some changes of qualitative and quantitative composition of zooplankton communities resulting from polluted waters as well as some changes due to fresh water influx. (Deal-EIS)
W80-02371

A PROBABILISTIC ASSESSMENT OF METHYL MERCURY TOXICITY RESULTING FROM THE CONSUMPTION OF TUNA FISH,
Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. of Protection.
R. Magnaval, R. Batti, A. Guezengar, R. Bittel, and A. Bouville.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27, Novembre 1978. Antalya, Turkee, p 663-666, 1979.

Descriptors: *Mercury, *Toxicity, *Simulation analysis, Statistical analysis, Analytical techniques, Heavy metals, Probability, Monte Carlo method, Path of pollutants, Public Health, *Methylmercury.

The toxicity of methyl mercury is sufficiently high at low doses to justify an evaluation of the risk related to the various parameters pertaining to the consumption of contaminated food. The originality of the method lies in the fact that distribution frequencies are assigned to the parameters in question, rather than mean values. The total body burden is evalutaed by numerical simulation on a digital computer (Monte Carlo method). Based on recorded cases of incipient intoxication and allowing a safety factor of 10, the critical body burden has been estimated between 5.4 and 6 mg total mercury. By applying this simulation in the case of Mediterranean red tuna fish consumption, it appears that there exists a critical group, as the population consumes this species of fish repeatedly. Toxic levels are never reached. (Deal-EIS)
W80-02373

FISH EGGS DIMENSIONS AND POLLUTION,
Athens Univ., (Greece). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-02375

INVESTIGATION OF THE FATE OF SOME CHLORINATED HYDROCARBONS IN LABORATORY GROWN PHYTOPLANKTON CULTURE,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
M. Picer, N. Picer, F. Krsinic, and V. Sipos.
In: IVes journees d'eutdes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978. Antalya, Turkee, p 453-456, 1979. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Laboratory tests, *Methodology, *Path of pollutants, DDT, DDE, Dieldrin, Aroclors, Polychlorinated biphenyls, Phytoplankton, Research equipment, Chlorinated hydrocarbon pesticides, Pesticide kinetics.

The fate of DDT and its metabolites DDE and TDE as well as dieldrin and Aroclor 1254 in laboratory cultures is described. The equipment used in phytoplankton culture studies was analysed to determine what percentage of the pollutants was taken up by the equipment. The range of pollutants recovered from filters, flasks, caps, and other equipment was extremely high. For example, from 3 to 29% of the DDT in an experiment was recovered in this manner. The problems generated by this high variability in interpreting experimental results are briefly discussed. (Deal-EIS)
W80-02376

ON THE EFFECTS OF DDT ON ENZYME ACTIVITIES IN MUGIL CEPHALUS L.,
Institut za Oceanografiju i Ribarstvo, Split (Yugoslavia).
For primary bibliographic entry see Field 5B.
W80-02377

EUTROPHICATION IN A BRACKISH DELTA LAKE,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
Y. Halim, and S. K. Guerguess.
In: IVee journees detudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L' Exploration Scientifique De La Mer Mediterranee, Mkonaco, 24-27 November 1978, Antalya, Turkee, p 435-438, 1979. 4 Fig.

Descriptors: *Eutrophication, *Lakes, *Sewage effluents, Aquatic populations, Biological communities, Dominant organisms, Tilapia, Shrimp, Phytoplankton, Diatoms, Water chemistry, Dissolved oxygen, Chlorophyta, Nutrients, Phosphates, Mediterranean Lake Menzalah, Nile River, Damietta Nile Branch, Public health.

Lake Menzalah, an extensive but shallow coastal lake located east of the Damietta Nile branch, derives its waters from agricultural drainage which ultimately outflows to the Mediterranean through four lake-sea connections. Its approximate flushing time is three months. About 110,000.000 cu m of

treated and diluted sewage water are discharged monthly into its S E basin. Nearly anoxic and azoic conditions prevail around the outfall, but rapid recovery follows the heavy development of plant life within a few dilometres: submerged macrophytes (Potamogeton, Ceratophyllum) with a dense growth of epiphytic diatoms, and phytoplankton (diatoms and green algae). The DO rises to near saturation but the Euglene/phytoplankton index is high, 1:25, compared to that of the remote lake basin, 1:300. Animal life is abundant in the recovery zone, characterized by herbivores, particle and detrital feeders: the rotifer Brachyonus ealycyflorus, mysis of Palaemonetes sp, the hydrophyte epizoans Vorticella sp and Gammarus sp. The S E lake basin is outstandingly productive in Tilapia fish, but infectious diseases appear to be a hazard to humans. The ecosystem is outlined. (Deal-EIS)
W80-02378

THE BENTHOS OF RIJEKA BAY - SUBJECT TO STRESS OF POLLUTION,
Institut Rudjer Boskovic, Rovinj (Yugoslavia).
D. Zavodnik, and N. Zavodnik.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkee, p 405-410, 1979. 23 Ref.

Descriptors: *Benthic fauna, *Benthic flora, *Water pollution effects, Biological communities, Aquatic populations, Dominant organisms, Sewage effluents, Industrial wastes, Benthos, Littoral, Bays, Habitats, Spatial distribution, Temporal distribution, Jugoslavia, Bay of Rijeka, *Biocoenoses.

The benthic Community of Rijeka Bay (Yugoslavia) was studied for the effects of industrial and domestic pollution. In the Bay of Rijeka, benthic communities are directly affected by domestic sewages and industrial wastes only in the mediolittoral and upper infralittoral zones. The degradation of biocoenoses is reflected by their conversion to nitrophile facia, and by the narrowing of the vertical distribution pattern of seaweed associations. Coastal communities affected by pollution are generally distributed in Bakar Bay and along the north and north-western coasts of Rijeka Bay. Other parts of Rijeka Bay are considered as still not seriously affected by pollution. The specific vertical and horizontal distribution of pollution affected zones and areas respectively, depend on the system of steady currents in the water body. Benthic communities in greater depths (usually below 20 m), are affected locally by silting and near-the-bottom microphytes, to which an increased presence of nutrients and other environmental conditions can give rise. (Deal-EIS)
W80-02379

RECOVERY OF INVERTEBRATE AND VERTEBRATE POPULATIONS IN A COAL ASH STRESSED DRAINAGE SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
D. S. Cherry, S. R. Larrick, R. K. Guthrie, E. M. Davis, and F. F. Sherberger.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1089-1096, 1979. 2 Fig, 3 Tab, 30 Ref.

Descriptors: *Invertebrates, *Fish populations, *Toxicity, *Livebearers, Coal, Fossil fuels, Aquatic populations, Acidic water, Industrial wastes, Hydrogen ion concentration, Diptera, Waste treatment, Water quality, Aquatic insects, Copper, Zinc, *Coal ash, *Fly ash, *Mosquitofish, *Bioaccumulation, *Tissue analysis.

The influence of coal ash effluent upon the densities of macrobenthic invertebrate and mosquitofish (Gambusia affinis) populations in a swamp drainage system was studied for a period of 50 mo. Density of the aquatic biota was periodically altered by three major perturbations: (1) heavy ash siltation from inefficient basin operation, (2) lowered pH from the fly ash addition, and (3) coal ash associated elemental concentrations. Siltation appeared to be most influential in reducing the invertebrate densities while low pH (mean change from 7.2 to 5.5 extreme of 3.5) was more effective in reducing mosquitofish populations and retarding the recovery of invertebrates. Dipterans and odonates were the invertebrates most tolerant to coal ash stress. Upon the completion of an efficient primary-secondary retaining basin system, most invertebrate groups in the swamp were able to recover to a level of abundance equal to or greater than that which existed 4 yr earlier. (Deal-EIS)
W80-02381

CHANGES IN THE APPARENT TEMPERATURE OPTIMA OF THE PLANKTON OF LAKE MICHIGAN AT CHICAGO, ILLINOIS,
State Univ. of New York Coll. at Brockport. Dept. of Biological Sciences.
J. C. Makarewicz, R. I. Baybutt, and K. Damann.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1169-1173, 1979. 4 Fig, 1 Tab, 8 Ref.

Descriptors: *Phytoplankton, *Water temperature, *Dominant organisms, Lake Michigan, Seasonal, Habitats, Biological communities, Productivity, Cyanophyta, Diatoms, Great lakes, Plankton, Temperature, Optima, Chicago, Illinois, Stephanodiscus, Asterionella, Fragilaria.

Forty years (1937-76) of data from Lake Michigan water intakes at Chicago, Illinois, were examined to explain reported differences in the apparent temperature optima of phytoplankton. The bimodal seasonal plankton distribution, typical at Chicago, still occurs. However, there has been a shift in seasonal periodicity with spring peaks occurring in March from 1957 to 1976 instead of May-June as previously reported for 1937-56. An optimum temperature of 10C for the plankton community was observed between 1936 and 1956, while for the last 20 yr an optimum temperature range from 0 to 4C was observed. This change in optimum temperature of the plankton community is related to a change in the abundance of the genera Asterionella, Fragilaria, Stephanodiscus, and Tabellaria, Asterionella and Fragilaria were the dominant spring plankton with maximum standing crops observed around 10C prior to 1956. Stephanodiscus first increased significantly in 1957 and was the dominant spring plankter through 1976. More recently (1972-76), blue-green algae have increased in numbers. Differences in apparent temperature optima reported are real and are caused by the emergence of cold water species of Stephanodiscus as the dominant spring plankter from 1957 to 1976. (Deal-EIS)
W80-02382

EFFECTS OF THERMALLY ELEVATED DISCHARGES ON THE STRUCTURE AND COMPOSITION OF ESTUARINE PERIPHYTON DIATOM ASSEMBLAGES,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.
M. K. Hein, and J. D. Koppen.
Estuarine and Coastal Marine Science, Vol 9, p 385-401, 1979. 7 Fig, 2 Tab, 32 Ref.

Descriptors: *Diatoms, *Nuclear powerplants, *Dominant organisms, *Cooling waters, Biological communities, Thermal pollution, Thermal stress, Heated water, Periphyton, Seasonal, Mathematical models, Statistical analysis, *Species diversity, *Diversity index, Oyster Creek Nuclear Generating Station, Forked River, New Jersey.

Periphyton diatom assemblages in the saline cooling water canal system of the Oyster Creek Nuclear Generating station were investigated for a twelve month period from December 1975 to December 1976. Uniform substrate samplers were placed in the intake canal water and the heated discharge canal water. These remained for 30 days before recovery to allow representative periphyton assemblages to develop. The structure and composition of the diatom assemblages in the two canals were compared. Thermal responses of indivudual taxa were difficult to identify; however, when the structure of the assemblages in the two canals were compared the effects of the thermally elevated effluent can be seen. In general, the assemblages in the heated effluent had fewer species, lower diversity indices, and greater redundancy. A degree of difference measure was used to show the differences between the assemblages at the two sites. Also, evidence is presentd that theermal stress above a critical temperature for short periods is detrimental to the structure of the assemblages. (Deal-EIS)
W80-02386

FACTORS INFLUENCING DISTRIBUTION OF MUSSELS IN THE BLANCO RIVER OF CENTRAL TEXAS,
Southwest Texas State Univ., San Marcos. Dept. of Biology.
F. R. Horne, and S. McIntosh.
The Nautilus, Vol 94, No 4, p 119-133, 1979. 1 Fig, 10 Tab, 37 Ref.

Descriptors: *Mussels, *Spatial distribution, *Rivers, Sewage effluents, Toxicity, Habitats, Water chemistry, Flow rate, Ammonia, Dissolved oxygen, Oxygen requirements, Animal metabolism, Nutrients, Benthic fauna, Texas, *Substrates, Water pollution effects.

Environmental parameters that influence the distribution of eight mussels in the Blanco River of Central Texas were studied. The effects of type of substrate, stream flow rate and physiochemical features on mussel distribution were evaluated, but emphasis was given to the role of organic enrichment of the river by a city sewage treatment plant. From tolerance tests to ammonia and low oxygen on five local mussels and from field studies, the following remarks can be made about mussel distribution in the Blanco River. (1) Low dissolved oxygen levels (0 - 0.5 mg O2/1) proved lethal to 47% of the mussels tested in seven days. (2) Levels of 5 mg NH+4 - NH3/l (pH 7.8 to 8.0; NH3 - N = 0.26 mg/l were lethal to 40% of the mussels tested in seven days. (3) Corbicula manilensis was more tolerant, and Amblema p. plicata less tolerant than the other mussels tested to elevated ammonia and low oxygen concentrations associated with sewage enrichment. (4) Even though the physiochemical parameters did not indicate stressful conditions on the days sampled, mussels of the Blanco River seemed to have been adversely effected by enrichment from the secondary sewage treatment plant of San Marcos. Fewer mussels were found downstream from the sewage plant than upstream, even where the river bottom, depth, and flow rates were similar. (Deal-EIS)
W80-02387

SPHAERIIDAE AS INDICATORS OF TROPHIC LAKE STAGES,
Smithsonian Institution, Washington, DC.
A. H. Clarke.
The Nautilus, Vol 94, No 4, p 178-184, 1979. 3 Fig, 1 Tab, 13 Ref.

Descriptors: *Bioindicators, *Trophic level, *Mollusks, Lakes, Oligotrophy, Mesotrophy, Eutrophication, Habitats, Spatial distribution, Dominant organisms, On-site-investigations, Arctic, *Sphaeriidae.

Analysis of field data associated with 35 species of boreal and arctic North American Sphaeriidae indicates interesting correlations between species occurrences and types of lentic habitats. A few species combine the attributes of stenotopy, broad geographical distribution, relative abundance and relative ease of taxonomic identification and appear to be of use as trophic lake stage indicators. These are: Pisidium conventus Clessin and Sphaerium nitidum Clessin for oligotrophic lakes, P. idahoense Roper and S. striatinum (Lamarek) for mesotrophic lakes, and P. rotundatum Prime and S. simile (Say) for eutrophic lakes. (Deal-EIS)
W80-02388

STUDIES ON THE TOXICITY OF RIVERS -I TOXICITY OF THE URAKAMI RIVER IN NAGASAKI CITY (IN JAPANESE),
Nagasaki Univ. (Japan). Faculty of Fisheries.
For primary bibliographic entry see Field 5A.
W80-02389

LEAD IN SPOTTED WOLFISH, ANARHICHAS MINOR, NEAR A ZINC-LEAD MINE IN GREENLAND,
Copenhagen Univ. (Denmark). Inst. for Petrology.
For primary bibliographic entry see Field 5B.
W80-02394

MOLT-RELATED SENSITIVITY OF DAPHNIA PULEX IN TOXICITY TESTING,
Waterloo Univ. (Ontario).
For primary bibliographic entry see Field 5A.
W80-02396

A DIRECT METHOD FOR STUDYING THE EFFECTS OF POLLUTANTS ON THE SEA BED,
For primary bibliographic entry see Field 5B.
W80-02398

5D. Waste Treatment Processes

SYSTEM FOR THE CLARIFICATION OF WASTE WATER AND UTILIZATION OF WASTE PRODUCTS,
A. H. Borst.
US Patent No 4,165,289, 29 p, 17 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 691-692, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Water purification, *Water pollution treatment, Sludge treatment, Waste disposal, Incineration, Filtration, Equipment, Coals, Gases.

A solid and liquid waste disposal and treatment plant, and a method for operating the plant is described. Solid waste received in the plant is incinerated in one or more rotary drums placed in a closed furnace chamber. The solid waste incineration takes place under an oxygen deficiency to liberate heat energy and generate a combustible gas. A pyrolyzation or carbonization drum is also placed in the furnace chamber and heated with the liberated heat energy. Organic matter, primarily organic sewage sludge is placed into the pyrolyzation drum and carbonized to produce coal. The coal is placed into a two-stage coal filter for the filtration of incoming sewage. The second stage of the coal filter utilizes coal activated within the plant for the removal of both particulate and dissolved contaminants so that the effluent from the filter comprises usable water. The combustible gas is cracked in a cracking unit to form short chain hydrocarbons and the gas is utilized in an internal or external combustion engine, a furnace or liquefied for subsequent use. Hot exhaust gases generated in the furnace and in the combustion engine are cooled by directing it through suitable heat exchangers or over wet solid waste or wet, sludge saturated filter coal to dry them while cooling the exhaust gas to further cleanse the exhaust gas of pollutants for its discharge to the atmosphere. Sludge saturated filter coal is regenerated in the furnace by carbonizing organic sludge adhering to the filter coal or it may be incinerated with solid waste. (Sinha-OEIS)
W80-02011

PROCESS OF TREATING WASTE WATER FROM A TEXTILE VAT DYEING OPERATION TO PRODUCE A CONCENTRATE FOR REUSE,
Riegel Textile Corp., New York. (Assignee).
R. K. Teed, and E. A. Freeman, Jr.
US Patent No 4,165,288, 13 p, 6 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 691, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Dyes, Filtration, Reverse osmosis, Water reuse, Product recovery.

A process for treating waste water from a textile vat dyeing operation containing water, vat dyes, and dissolved and undissolved impurities including salts, lint, foreign matter, etc. to produce a concentrate suitable for direct reuse in the vat dyeing operation to conserve the use of dyes and water is described. Undissolved impurities of a predetermined particle size are filtered out. Thereafter, the waste water is concentrated and filtered down to a concentrate of a ratio of from about 30/1 to 200/1 while removing excess water and a substantial portion of the remaining impurities and retaining substantially all of the vat dyes and a desired amount of water. This concentrate is suitable for immediately using in the chemical feed tank and mixing into the dye mix of a conventional vat dye range without further treatment. The latter step is performed by circulating the waste water through a reverse osmosis filtration device, while separating the waste water into a permeate containing excess water and a substantial portion of the remaining impurities including salts and a concentrate containing substantially all of the vat dyes and a desired amount of water, and by removing the permeate and retaining the concentrate for reuse in the dyeing operation. (Sinha-OEIS)
W80-02018

APPARATUS FOR THE INTERMITTENT AERATION OF SEWAGE,
A. Schreiber, and S. Rudolph.
U.S. Patent No 4,165,286, 5 p, 4 Fig, 11 Ref, Official Gazette of the United States Patent Office, Vol 985, No 3, p 690, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Aeration, Equipment.

An apparatus for the intermittent aeration of sewage or sewage-activated sludge mixtures is placed below water level and consists of a horizontal air distributor in the form of a pipe jacket closed tightly at both ends except for an aperture for the air supply. The apparatus further includes an elastic air distributing foil covering the apertures for the passage of air and the upper portion of the pipe jacket. The foil is provided with air escape openings which are opened by the air supply to the pipe jacket and closed in case of interruption of the air supply by being sealed against the pipe jacket outside the area of the air passage openings. The apparatus further includes distancing strips located at the two opposite lateral longitudinal edges of the pipe jacket, below the openings for the passage of air and between the pipe jacket and the air distributor foil. (Sinha - OEIS)
W80-02028

COMBINED ANAEROBIC REACTOR AND SETTLER,
N.V. Centrale Suiker Maatschappij, Amsterdam (Netherlands). (Assignee).
E. Wind, and R. de Vletter.
U.S. Patent No 4,165,285, 8 p, 3 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 690, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Anaerobic conditions, Methane, Equipment.

The invention relates to an installation for anaerobic purification of waste or effuent water comprising particles which comprises a reactor, an after-settler device in the top part of the reactor which separates an upper settling zone from an anaerobic decomposition zone, and means are provided for using the developed methane gas as a transport aid of the particles and for separating the gas from the particles. (Sinha-OEIS)
W80-02029

MULTI-STAGE PURIFICATION SYSTEM,
Industrial Pollution Control Corp., Ludlow, MA. (Assignee).
R. E. Weber, and C. J. Zimmerman.
U.S. Patent No 4,165,283, 21 p, 21 Fig, 22 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 689, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water purification, Separation techniques, Flow, Filtration, Sedimentation, Equipment.

A multi-stage, single vessel system for removing contaminants from water is described. A contaminated liquid is fed into a deceleration chamber and decelerated. In this chamber the lighter solid particles rise to the top of the liquid where they are removed, while the heavier density particles settle downward. As the liquid moves downward from the deceleration chamber it essentially displaces liquid in the settling chamber upward into the filtering chamber. In so doing the change of direction of liquid movement also causes the heavier particles to settle downward. Concurrently the rising liquid in the filtering chamber passes through septums where sufficient quantities of remaining solid contaminates are removed to provide purified water ready for reuse or discharge. The solid contaminates are received by the explusion device which removes residue liquid and compacts the solid contaminantes. The deceleration chamber is within the central portion of the vessel and has flow control means. About and substantially coextensive with the deceleration chamber is a filtering chamber. Depending well into the filtering chamber are septums preferably coated with filter aid. Below the deceleration and filtering chambers is a settling chamber and beneath the vessel is an expulsion device. (Sinha - OEIS)
W80-02032

MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX I: PLAN FORMULATION.
Corps of Engineers, Buffalo, NY. Buffalo District.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 055, Price codes: A06 in paper copy, A01 in microfiche. August 1973. 107 p, 3 Attachments.

Descriptors: *Waste water treatment, *Planning, *Waste water management, *Water management(Applied), *Plan formulation, *Cleveland(OH), *Akron(OH), *Three Rivers Watershed(OH), Ohio, Management, Alternative planning, Projections, Schedules, Administration, Coordination, Decision making, Governments, Institutions, Methodology, Regional development, Water resources, Chagrin River(OH), Cuyahoga River(OH), Rocky River(OH).

The purpose of this study is to address the problem of wastewater management in the Three Rivers Watershed Area and the Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, the Cuyahoga and the Rocky. Approximately 23% of the area's 1500 square miles are urbanized. This appendix seeks to develop logically the process used in generating alternatives, analyzing these alternatives, and then selecting the best alternative for the solution of the problem. Various management systems were formulated by a three-step process: information gathering, systems design, and evaluation. Technical objectives are presented: to prevent the continued degradation of water resources, and to provide for the efficient reuse of treated wastewater and its separated constituents. Levels of effluent water quality are established and applied to certain reaches and circumstances. The study organization is capsulized, followed by a review of study procedure. The information gathering phase included the determination of flows and loads from principal pollution sources, identification of soils areas suitable for effluent land treatment, and background enviromental and institutional conditions. The systems design phase included the formulation of a spectrum of alternative wastewater management systems, designing their components, estimating their costs and evaluating, their environmental and institutional impacts. This phase ultimately resulted in the 12 alternatives displayed in this appendix's Attachment B. The evaluation phase consisted of the reformulation of three alternative plans, based on the 12 preliminary alternatives, the design of those plans, and the development of an implementation schedule for each. (Zayac-NC)
W80-02037

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, AP-

PENDIX III: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Haven and Emerson Ltd., Cleveland, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 150, Price codes: A04 in paper copy, A01 in microfiche. Prepared for U.S. Army Corps of Engineers, Buffalo District, April 1972. 58 p, 9 Tab.

Descriptors: *Waste water treatment, *Rainfall-runoff relationships, *Stormwater, *Storm runoff, *Urban runoff, *Waste waTer management, *Cleveland(OH), *Akron(OH), *Three Rivers Watershed(OH), Planning, Ohio, Waste water disposal, Waste water(Pollution), Municipal wastes, Municipal water, Sludge disposal, Domestic wastes, Cities, Surface runoff, Management, Costs, Chagrin River(OH), Cuyahoga River(OH), Rocky River(OH).

This report is part of a study undertaken to address the problem of wastewater management in the Three Rivers Watershed and Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, the Cuyahoga and the Rocky. Approximately 23% of the area's 1500 square miles are urbanized. This specialty Appendix III describes the results of a study of water-based treatment of municipal wastewater and stormwater. The industrial waste treatment, land-based treatment and plan formulation are the subjects of other specialty appendices. This appendix consists of a Summary Report and three technical appendices. The Summary Report first discusses water quality goals, i.e., to establish a target for design of treatment processes for municipal wastewater, combined overflow and stormwater runoff. Two levels of treatment were established: Level 1, to reflect the proposed State Standards; and a higher Level 2, reflecting current technological limits. Design criteria and a methodology for developing alternatives are discussed in relation to both municipal wastewater and stormwater runoff. Cost estimation methodology and criteria are reviewed for unit costs and composite costs; procedures for estimating costs for preliminary and final alternatives are outlined. For the 12 preliminary alternatives, cost estimations and electrical power and chemical requirements are presented. These are also presented for the three final alternatives. The technical appendices contain the details of the work and rationale behind the selection of the basis of design and cost. (Zayac-NC)
W80-02039

WASTEWATER, MANAGEMENT STUDY, FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX VII: INSTITUTIONAL EVALUATION.
Linton and Co., Inc., Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 154, Price codes: A07 in paper copy, A01 in microfiche. Prepared for U.S. Army Corps of Engineers, Buffalo District August 1973. 127 p.

Descriptors: *Waste water treatment, *Institutions, *Watershed management, *Waste water management, *Cleveland(OH), *Akron(OH), *Three Rivers Watershed(OH), Ohio, River basin development, Institutional constraints, Organizations, Planning, Administration, Administrative agencies, Management, Federal government, Local government, State governments, Evaluation, Chagrin River(OH), Cuyahoga River(OH), Rocky River(OH).

This report is part of a study undertaken to address the problem of wastewater management in the Three Rivers Watershed and Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, Cuyahoga and Rocky. Aproximately 23% of the area's 1500 square miles are urbanized. App VII is comprised of 6 parts. Part I summarizes qn initial survey of institutional arrangements and classifies wastewater service organizations by function. Relationships between organizations performing the same functions are explored: legal and administrative restrictions are summarized; future plans or organizations outlined; and financial aspects of the area addressed. Part II presents individual status reports on institutions in the study area. Federal government institutions with wastewater related responsibilities are discussed in Part III. Part IV is an institutional evaluation of financial and manpower factors in the study area, and is divided into three sections: institutions concerned with analytical purposes; financial arrangements among wastewater management institutions; and an analysis of manpower factors. Part V is an evaluation of institutional impacts of the 12 preliminary alternatives considered in the comprehensive planning process. Factors summarized for each alternative are financial, regional, resource re-use and land. Part VI presents an evaluation of the final three alternatives considered and discusses institutional arrangements which could be used in implementation. It contains: summary of impacts for each alternative; discussion of the impacts; alternative institutional arrangements for use in implementation; and institutional arrangements which are evaluated in terms of the extent to which they meet institutional criteria. (Zayac-NC)
W80-02040

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS. IX: AGRICULTURAL EVALUATION.
Ohio Agricultural Research and Development Center, Columbus.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 054, Price codes: A07 in paper copy, A01 in microfiche. Prepared for U.S. Army Corps of Engineers, Buffalo District, July 1973. 136 p.

Descriptors: *Agriculture, *Agronomy, *Rural areas, *Land management, *Land treatment, *Waste water management, *Cleveland(OH), *Akron(OH), *Three Rivers Watershed(OH), Ohio, Social aspects, Environmental effects, Economic impact, Economic justification, Agricultural engineering, Agricultural watersheds, Agronomic crops, Farm management, Land classification, Crop production, Crop response, Soil management, Soil science, Fish management, Wildlife management, Economics, Irrigation, Evaluation, Chagrin River(OH), Cuyahoga River(OH), Rocky River(OH).

This report is part of a study undertaken to address the problem of wastewater management in the Three Rivers Watershed and Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, the Cuyahoga and the Rocky. Approximately 23% of the area's 1500 square miles are urbanized. Appendix IX considers the agricultural, environmental, social and economic impacts on the rural and farming communities involved in the study area. Consultant reports in each of five major areas--engineering, agronomics, fish and wildlife, economic and social--are evaluated. Engineering considerations discussed are drainage, irrigation, land management and hydrology. Under agronomic concerns, soil selection, crop selection and management, land disposal, soil renovation and sludge disposal are reviewed. Watershed management, enhancement of aquatic biota and lagoons and storage reservoirs are discussed under fish and wildlife considerations. Among the social and economic considerations reviewed are: economic and social dimensions; farm practices; market developments; land treatment; and water quality. The appendix then looks in depth at a land disposal alternative, its justification, implementation, description and impacts on rural life. Finally, land treatment projects for small and medium sized communities are outlined. Included here are agronomic aspects of evaluation and monitoring, engineering aspects of evaluation, designing wildlife benefits and community perception and acceptance. Conclusions indicate that land disposal is a viable alternative with proper management, but that effects of some of the proposed intensive land treatment are unacceptable. Community acceptance of land treatment is essential (Zayac-NC)
W80-02041

WASTEWATER MANAGEMENT ALTERNATIVES FOR THE CLEVELAND-AKRON, THREE RIVERS WATERSHED AREA: TECHNICAL APPENDIX-PHASE I: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Corps of Engineers, Buffalo, NY. Buffalo District.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 833, Price codes: A08 in paper copy, A01 in microfiche. February 1973. 196 p, 9 Fig, 28 Tab, 5 Append.

Descriptors: *Waste water(Pollution), *Waste water disposal, *Waste water treatment, *Hydrograph analysis, *Storm runoff, *Urban runoff, *Agricultural runoff, *Waste water management, *Cleveland(OH), *Akron(OH), *Three Rivers Watershed(OH), Ohio, Reclaimed water, Sanitary engineering, Water policy, Water quality, Unit hydrographs, Surface runoff, Average runoff, Cities, Overland flow, Storm water, Urban hydrology, Rainfall runoff relationships, Runoff coefficient, Runoff forecasting, Land use, Water reuse, Chagarin River(OH), Cuyahoga River(OH), Rocky River(OH).

The Cleveland-Akron area was chosen by the Corps of Engineers as one of five pilot areas in which to develop a wastewater management program. This report is part of a study undertaken to address the problem of wastewater management in the Three Rivers Watershed and Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, the Cuyahoga and the Rocky. Approximately 23% of the area's 1500 square miles are urbanized. This volume covers Phase I of the study, and identifies the wastewater management problem with respect to municipal and stormwater runoff wastewater both as it exists today and is anticipated. It is in the nature of a progress report. Section One on municipal wastewater first studies the area's demography. These data are then used to assess present and expected land use patterns. Existing wastewater treatment plants are numerated and reviewed, followed by their values. Subdistricts within service areas are outlined and wastewater flows and loads, both present and future, are presented. The re-use potential of these wastewaters is assessed. Qualities of stream flow are reviewed; sediment deposits in the study area are then studied. Section Two deals with stormwater runoff. Drainage districts are outlined and rainfall is assessed as a base for determining drainage criteria. Runoff factors are developed and hydrographs presented. Both urban and rural stormwater runoffs are evaluated. The volume also contains appendices studying the design storm, drainage area characteristics and percent imperviousness, and hydrographs and loads. (Zayac-NC)
W80-02042

MUNICIPAL RECYCLING OF WASTEWATER,
Denver Research Inst., CO.
J. G. Milliken, and A. S. Trumbly.
American Water Works Association Journal, Vol 71, No 10, p 548-555, October 1979. 3 Fig, 4 Tab, 12 Ref.

Descriptors: *Waste water treatment, *Municipal water, *Water use, *Advanced waste treatment, *Water costs, *Health aspects, *Water supply, *Recycling, *Reclaimed water, *Recirculated water, *Waste water reclamation, Water resources, Potable water, Agricultural use, Industrial use, Groundwater recharge, Social aspects, Water reuse.

This article surveys and summarizes knowledge about renovating and directly recycling wastewater from industrial and municipal sewage for a variety of uses. Advanced Wastewater Treatment (AWT) processes have been developed to recycle wastewater into water usable for drinking, though such use is still quite controversial. Other methods of using water of lower quality include establishing dual distibution systems which establish a separate system for recycled water only; use of recycled water for industry to offset increasingly scarce fresh water supplies more appropriately used for drinking purposes; agricultural use of recycled water; exchange of wastewater return flows for fresh water destined for nonmunicipal use; and pumping treated wastewater effluent into groundwater aquifers, a method already used in the Los Angeles and New York metropolitan areas. In considering a wastewater recycling system, water

service costs must be expressed as the sum of collection, treatment, distribution and wastewater treatment costs to determine its feasibility for a particular area. When combined with inexppensive deep well water, the recycled wastewater can be used economically in a system and will offset large operation and maintenance costs. Health concerns about the use of such water and traditional lack of public acceptance of water re-use, particulaly for drinking, remain. Nevertheless, potable recycled water supplies may be feasible by 1995. (Arnold-NC)
W80-02044

METHOD AND UNIT FOR WASTEWATER TREATMENT BY MICROORGANISMS,
Niigata Engineering Co., Ltd., Tokyo (Japan). (Assignee).
K. Kuriyana, M. Sato, T. Matsuzaki, M. Honma, and S. Shida.
U.S. Patent No 4,165,281, 16 p, 12 Fig, 23 Tab, 8 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 689, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Organic wastes, Microorganisms, Aeration, Equipment, Oxidation.

A method and a unit for wastewater treatment with microorganisms is described, in which at least one non-woven fibrous mat having a three-dimensional network structure is disposed as a supporting media in an aeration tank. The microorganisms are retained on the surface of and in the interstices of the non-woven fibrous mat, and organic polluting matter in the wastewater is oxidatively decomposed by the microorganisms in the presence of oxygen. (Sinha-OEIS)
W80-02063

AUGER TYPE SCREENING DEVICE FOR REMOVING SEDIMENT AND THE LIKE FROM SOLUTIONS,
R. P. Briltz.
U.S. Patent No. 4,164,470, 8 p, 16 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 985, No 2, p 414, August 14, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, *Separation techniques, Flocculation, Sedimentation, Water purification, Equipment, Augers, Tube clarifiers.

The invention consists of a modular liquid treatment assembly comprising in combination, means to treat the liquid to induce formation of solids and at least one tube calrifier. The clarifier includes a casing, an inlet, a solids outlet and a liquid outlet. An auger assembly journalled for rotation within the casing urges the settled solids towards the solids outlet and the liquids pass from the casing through the liquid outlet. (Sinha-OEIS)
W80-02083

METHOD OF CLEANING PHENOL-CONTAINING WASTE WATERS,
Acieries Reunies de Burbach-Eich-Dudelange S.A., Luxembourg. (Assignee).
A. Wagner.
U.S. Patent No 4,164,469, 4 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 985, No 2, p 414, August 14, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Phenols, Adsorption, Separation techniques, Brown-coal coke.

A method of cleaning phenol-containing waste waters as derived from coke-producing, chemical and other industrial processes comprises treating the waste water, generally without any preconcentration of the phenol cntent thereof or other prior treatment, with a one-use adsorbent, namely, brown-coal coke. The brown-coal coke is then subjected at least in part to a thermal treatment which can be a coke producing process or combustion. (Sinha-OEIS)
W80-02089

LAND TREATMENT VS. AWT--HOW DO COSTS COMPARE,
Metcalf and Eddy, Sacramento, CA.
For primary bibliographic entry see Field 6C.
W80-02145

VACUUM-TYPE WATER REMOVAL SYSTEM FOR HOUSES, FACTORIES, SHIPS AND THE LIKE,
Electrolux, G.m.b.H., (Germany, F.R.). (Assignee).
H. R. Michael.
U.S. Patent No 4,164,049, 4 p, 2 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 985, No 2, p 275, August 14, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Domestic wastes, Waste disposal, Valves, Equipment, Vacuum systems.

A vacuum-type water removal system for buildings, factories, ships and the like is provided wherein waste water collection devices, such as sanitary facilities (e.g. toilets) and other waste producing/or collecting devices, are connected through a cut-off valve to a vacuum conduit for removal of the waste water. The invention concerns the provision of a supplemental arrangement including an overflow opening for the collection devices which is connected to a gravity feed line that feeds a collection chamber connected through a check valve to the vacuum line. (Sinha-OEIS)
W80-02148

INTERCHANGE OF METALS AND ORGANIC MATTER BETWEEN WATER AND SUBBITUMINOUS COAL OR LIGNITE UNDER SIMULATED COAL SLURRY PIPELINE CONDITIONS,
Missouri Univ.-Columbia. Dept. of Chemistry.
J. Godwin, and S. E. Manahan.
Environmental Science and Technology, Vol 13, No 9, p 1100-1104, September 1979. 6 Fig, 2 Tab, 9 Ref. OWRT A-110-MO(1), 14-34-0001-9027.

Descriptors: *Coal, Pipelines, *Slurry transport, Coal slurry pipelines, Humic acid, Metal transport, Metal solubilization, Atomic absorption analysis.

The uptake of metals and organic matter from granular subbituminous coal and lignite by water was investigated under simulated coal slurry pipeline conditions. The metals present at levels well over 1 ppm in both types of coal were Fe, Ca, Mg, Al, Na, K, Mn, Pb, Cu, Zn, Co, Ni, Cr, and Li. Of these, Pb, Co, Ni, and Cr were not detectable by flame atomic absorption in the slurry water separated from the coal. The percentage of metal extracted from the coal varied widely with the type of metal and with the coal/water ratio in the slurry, spanning a range of 0.01 to 75%. Humic acids were present at coal percentages below 5% and were shown to be involved in the solubilization of iron, copper, and aluminum.
W80-02151

POLAROGRAPHIC CHARACTERIZATION OF NITROHUMIC ACIDS PREPARED BY NITRIC ACID OXIDATION OF COAL,
Missouri Univ.-Columbia. Dept. of Chemistry.
J. B. Green, and S. E. Manahan.
Analytical Chemistry, Vol 51, No 8, p 1126 - 1129, July 1979. 4 Fig, 2 Tab, 24 Ref. OWRT B-115-MO(4), 14-34-0001-6095.

Descriptors: *Coal, Humic substances, *Humic acids, Polarography, Copper, Metal binding.

Humic acids prepared by the partial oxidation of bituminous coal with nitric acid have been analyzed polarographically. A major shift in the half-wave potential for the polarographic reduction of the nitro group at pH 5 indicated that the most probable neighboring group is phenolic -OH. Nitrobenzoic acids have pKa's that are too low to account for the observed effect. It is possible that the preparation of humic acid by the nitric acid oxidation of coal also introduces some nitroso groups, the presence of which cannot be determined with the methods employed in this study. Humate salts prepared from coal are of interest for pollutant removal because of their chelation, flocculation, acid neutralization, and acid gas sorption properties.
W80-02152

EVALUATION OF MOUND SYSTEMS FOR PURIFICATION OF SEPTIC TANK EFFLUENT,
Wisconsin Univ.-Madison. Dept. of Soil Science.
J. M. Harkin, C. J. Fitzgerald, C. P. Duffy, and D. G. Kroll.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-122807, Price codes; A06 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin Technical Report, 1979. 310 p, 26 Fig, 18 Tab, 112 Ref. OWRT B-099-WIS(1), 14-34-0001-7200.

Descriptors: *Septic tanks, *Domestic wastes, *Sewage bacteria, *Sewage disposal, *Sewage treatment, Soil disposal fields, Water pollution source, Coliforms, Streptococcus, Pseufomonas, Viruses, Nutrient removal, Public Health, Alternative septic systems, Mound systems, Environmental sanitation, Water purification.

Thirty-three mound systems for on-site disposal of septic tank effluent (STE) installed by commercial contractors in Wisconsin were surveyed and monitored for 2-3 years to test whether they are being properly designed, installed and operated and are achieving adequate wastewater purification. Every system examined was correctly sized and constructed but many systems were being dosed inappropriately with large volumes of STE. In these systems, bacteria and nutrients (N and P) from the STE penetrate deeper into the soil than in systems removed bacteria, viruses and phosphorus effectively and reduced the N load passing through the soil by nitrification-dentrification. No evidence of contamination by bacteria, N or P could be found in high groundwater near 4 systems located over permeable soils. The pressure system used for STE distribution in Wisconsin mounds prevents the formation of biological crusts where the STE enters the soil, a phenomenon which leads to failure of conventional systems. Three cases of mound system failure reported in the state were found to be due to faulty construction, not improper design or clogging. Wisconsin mound systems are expected to outlive and out perform conventional septic systems.
W80-02153

ENHANCED BIODEGRADATION OF HYDROCARBONS: ROLE OF BIOFLOCCULANTS AND BIOEMULSIFIERS,
Rhode Island Univ., Kingston.
S. M. Barnett, K. Kulkarni, C. W. Houston, and A. R. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-123664, Price codes: A03 in paper copy, A01 in microfiche. Rhode Island Water Resources Center, University of Rhode Island Completion Report, September 1979. 40 p, 14 Fig, 1 Tab, 48 Ref. OWRT B-073-RI(1), 14-34-0001-7130.

Descriptors: *Biodegradation, *Organic compounds, *Hydrocarbons, Waste hydrocarbons, *Surfactants, Flocculation, Bioemulsifiers, Bioflocculants, Microorganisms.

Hydrocarbons are a major component of municipal and industrial waste streams. This study has concentrated on finding ways to enhance biological degradation of hydrocarbons. Surfactants were shown to promote the uptake of hydrocarbons by microorganisms. The beneficial effects of bioemulsifiers and bioflocculants were established and shown to be comparable with that of synthetic surfactants. Flocculation was found to play an important role. It aids hydrocarbon uptake and enhances cell growth, but when excessive, floc-resistance to nutrient transfer becomes rate-controlling. With appropriate additions of bioemulsifiers, bioflocculants and synthetic surfactants, flocculation could be controlled and growth characteristics modified to take advantages of both growth rates and better dewatering.

W80-02157

VALUE OF WETLANDS AS DOMESTIC ECOSYSTEMS,
Florida Univ., Gainesville. Center for Wetlands.
For primary bibliographic entry see Field 6B.
W80-02256

AQUATIC VEGETATION AND WATER POLLUTION CONTROL PUBLIC HEALTH IMPLICATIONS,
Texas State Dept. of Health, Austin.
R. Dinges.
American Journal of Public Health, Vol 68, No 12, p 1202-1205, December, 1978. 1 Fig, 3 Tab, 14 Ref.

Descriptors: *Rooted aquatic plants, *Waste water treatment, *Public health, Pollution, Water pollution treatment, Algae, Bacteria, Suspension, Wetlands, Texas.

Results obtained from pilot studies and the operation of a plant scale treatment facility located at the Williamson Creek Wastewater Treatment Plant at Austin, Texas, demonstrate that culture of the water hyacinth Eichhornia crassipes in shallow earthen basins is effective in the removal of algae, fecal coliform bacteria and deleterious impurities from wastewater stabilization pond effluent. Stabilization ponds followed by hyacinth culture constitute an economical, low energy treatment system which reduces significantly those potential health hazards associated with wastewaters. Harvested hyacinths represent a useful product which could be converted into compost, or used directly as a soil amendment. (Howard-Mass)
W80-02298

5E. Ultimate Disposal Of Wastes

SEWAGE SLUDGE TRANSPORT COSTS,
Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.
For primary bibliographic entry see Field 6C.
W80-02007

SYSTEM FOR THE CLARIFICATION OF WASTE WATER AND UTILIZATION OF WASTE PRODUCTS,
For primary bibliographic entry see Field 5D.
W80-02011

WASTEWATER APPLICATIONS TO IRON-ORE OVERBURDEN MATERIAL IN NORTHEASTERN MINNESOTA: PROSPECTS FOR RENOVATION AND RECLAMATION,
Minnesota Univ., St. Paul. Dept. of Forest Resources.
K. N. Brooks, J. P. Borovsky, and A. C. Mace, Jr.
In: Utilization of Municipal Sewage Effluent and Sludge on Forest and Disturbed Land, p 407-422 1979. Editors, Sopper, W. E. and S. N. Kerr. Pennsylvania State University Press. OWRT B-102-MINN (2) 14-31-0001-5127.

Descriptors: *Waste water disposal, *Sprinkler irrigation, *Water reuse, Sewage effluents, Nutrients, Water analysis, Soil analysis, Vegetation, Growth rates, Evaluation, Minnesota, *Iron-ore overburden material, Water renovation, Mesabi iron range(MN).

Sprinkler irrigation of secondary sewage effluent on iron-ore overburden material was investigated to determine renovation effects as indicated by changes in soil percolate quality, and to evaluate possible ameliorative effects as indicated by changes in soil chemistry. A 20-year-old stripping dump with poor drainage characteristics and a newly deposited overburden site were studied. Over 99 percent of total P from the applied effluent was removed by the overburden as measured at 1.2m - depth. Renovation of nitrate plus nitrite -N was observed only at the poorly drained site. Changes in soil nutrients were not detected following one summer of irrigation. (Blake-Minn)
W80-02052

PHYSICAL AND CHEMICAL WATER QUALITY CHARACTERISTICS OF THE FOX CHAIN OF LAKES,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Transactions of the Illinois State Academy of Science, Vol 71, No 3, p 239-259, November 1978. 7 Fig, 3 Tab, 13 Ref.

Descriptors: *Water quality, *Lakes, *Sampling, *Illinois, Data processing, Assessments, Physical properties, Chemical properties, Temperature, Water temperature, Dissolved oxygen, Turbidity, Suspended solids, Hydrogen ion concentration, Alkalinity, Hardness(Water), Nitrogen, Chlorides, Sulfates, Phosphorus, Iron, Silica, Dissolved solids, On-site investigations, Water pollution, Pollutants, Pollutant identification, *Fox Chain of Lakes(IL).

The Fox Chain of Lakes experiences luxuriant and prolonged algal blooms, periodic fish kills, offensive odors, and other symptoms of the advanced stage of eutrophication. All the deep lakes in the chain stratify thermally, and the hypolimnetic zones are totally devoid of oxygen. In the shallow lakes, even though the temperatures are uniform, or nearly so, for the entire depth, there is a significant drop in dissolved oxygen near the bottom of the lake. The oxygen demands exerted by the bottom sediments are much higher than the oxygen replenished from the atmosphere during the summer months. The lake waters are high in alkalinity and hardness, typical of midwestern surface waters. The pH values of lake surface water samples were never less than 8 during this investigation. This is indicative of active photosynthesis in which carbon dioxide is utilized from the bicarbonate alkalinity. Deep water samples had pH values less than 8 generally when the bottom sediments were undergoing anaerobic decomposition. The mean nitrate concentrations in all the lakes and at all depths examined were similar. The dissolved orthophosphorus concentrations in the deep water zones were observed to be several orders of magnitude higher than the values determined for surface and mid-depth water samples in these lakes. The phosphorus and nitrogen concentration levels in the lakes were much higher than the critical levels of nutrient concentrations suggested in the literature. (Sims-ISWS)
W80-02167

5F. Water Treatment and Quality Alteration

MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX I: PLAN FORMULATION.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5D.
W80-02037

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX II: COMMENTS.
Corps of Engineers, Buffalo, NY. Buffalo District.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 142, Price codes: A03 in paper copy, A01 in microfiche. August 1973. 43 p, 1 Fig, 1 Tab, 2 Attachments.

Descriptors: *Local governments, *Reviews, *State governments, *Waste water management, *Waste water treatment, *Costs, *Public participation, *Akron(OH), *Cleveland(OH), *Three Rivers Watershed(OH), Ohio, Instututions, Legal aspects, Social aspects, State jurisdiction, Agencies, Comments, Chargin River(OH), Cuyahoga River(OH), Rocky River(OH).

This report is part of a study undertaken to address the problem of wastewater management in the Three Rivers. Watershed and Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, the Cuyahoga and the Rocky. Approximately 23% of the area's 1500 square miles are urbanized. Appendix II presents the views of interested governmental agencies in Ohio based on their review of the study's draft report. However, the total coordination between the District office of the Corps of Engineers and other interested governmental agencies is not documented. Presented are reviews received through two media: final public meetings and written responses. These responses include technical reviews by governmental agencies and statements concerning acceptability to Ohio citizens. Citizen responses obtained through workshop, and briefings are reported in Appendix VIII. The following governmental agencies provided written review of the draft report: Ohio EPA and Dept. of Natural Resources; Three Rivers Watershed District: Huron County Board of Commissioners; Huron County Dept. of Health; Summit County Sanitary Engineers; City of Akron; City of Olmstead Falls. The two attachments include comments by Ohio agencies and responds to comments by the City of Akron. (Zayac-NC)
W80-02038

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX III: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Haven and Emerson Ltd., Cleveland, OH.
For primary bibliographic entry see Field 5D.
W80-02039

WASTEWATER, MANAGEMENT STUDY, FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX VII: INSTITUTIONAL EVALUATION.
Linton and Co., Inc., Washington, DC.
For primary bibliographic entry see Field 5D.
W80-02040

BUILDING FOR THE FUTURE: A NEW GENERATION OF WATER TREATMENT PLANTS IN KANSAS,
Black and Veatch, Kansas City, MO.
J. H. Robinson.
American Water Works Association Journal, Vol 71, No 6, p 310-314, June 1979, 2 Ref.

Descriptors: *Water demand, *Water treatment, *Water treatment plants, *Kansas, *Topeka(KS), *Junction City(KS), *Leavenworth(KS), *Lawrence(KS), *Water softening, Water resources, Water quality, Domestic water, Water, Utilities, Water works, Water supply.

Descriptions of the emerging new generation water treatment facilities in four cities in Kansas are described: Topeka, Junction City, Lawrence and Leavenworth. In Topeka a 76-ML/day (20-mgd) addition to the existing water plant is being constructed. One unconventional design feature of the addition is the series arrangement of the presedimentation basins which will remove turbidity and suspended solids from source water more effectively and economically. The feasibility of a solar heating system for the filter building is also being investigated. The plant addition also includes the addition of a 48 inch raw line extension to an existing 36 inch line which will reduce head loss. In Leavenworth a new water treatment facility is to be built and will include an induced-draft aerator, a primary basin of the solids-contact type, a rapid-mix chamber, a secondary clarifier of the center flocculator type, three 7.6-ML/day (2-mgd) dual media filters and three 11-ML/day (3-mgd) vertical turbine high service pumping units. Junction City is building a new 38-ML/day (10-mgd) water softening plant to replace the existing treatment plant. The expansion program calls for five new 57-L/s (900 gpm) supply wells. Lawrence is constructing a new water treatment plant in anticipation of delivery of water from a new 2800-ha (7000 acre) reservoir at Clinton on the Wakarusa River. The new water supply will be of high quality, the principal treatment concern being taste and odor problems that may result from algae blooms. (Iervolino-NC)
W80-02048

Group 5F—Water Treatment and Quality Alteration

DYNAMIC CONTROL OF THE COAGULATION PROCESS,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
P. J. Ossenbruggen, D. J. O'Brien, and W. J. Gallot.
American Society of Civil Engineers. Preprint 3560, Convention and Exposition, Boston, MA, April 2-6, 1979. 16 p, 6 Fig, 8 Ref. OWRT B-005-NH (1), 14-34-0001-9122.

Descriptors: *Coagulation, *Flocculation, *Water treatment, *Surface waters, *Color, *Turbidity, Water quality, *Water color removal, *Fulvic acid concentrations, *Water treatment plants, *Time series models.

Coagulation is a water treatment process utilized for removal of unwanted color and turbidity by chemical addition. It has been estimated that chemical costs associated with coagulation are at least $5 million per year for New England alone. Many water treatment plants in New England are small and do not have full time operators. Eighty out of 107 treatment plants in New Hampshire treat water for communities with populations of 10,000 people or less. The Community Water Supply Survey noted that two thirds of all water treatment plants operators have no formal training. For these and other reasons, overdosing of treatment chemicals in water treatment is felt to be widespread. This practice is very costly. The purpose of this paper is to describe the problems associated with the treatment of surface waters and to suggest a method to minimize the cost of treatment for small communities.
W80-02158

COMBINED ACTION OF POLYPHENOILS, QUINONES, REDUCERS AND CERTAIN OTHER COMPOUNDS ON AQUATIC PLANTS,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
D. J. Stom, and O. M. Kozhova.
Polskie Archiwum Hydrobiologii, Vol 23, No 3, p 401-408, 1976. 6 Tab, 7 Ref.

Descriptors: *Aquatic plants, *Stream improvement, *Pulp wastes, *Toxicity, *Sulfur compounds, *Phenols, Rooted aquatic plants, Submerged plants, Chemical wastes, Industrial wastes, Water pollution effects, Water pollution treatment, Organic wastes.

Thiol derivatives were tested for their ability to weaken the toxic action of phenolic compounds and sulfur containing derivatives from pulp and paper industrial waste waters. The toxic action of p-benzoquinone and polyphenols, as pyrocatechol and hydroquinone, on Nitella and Elodea, is stipulated by the oxidation products. It is substantially weakened in the presence of thiols (cysteine, glutathione, ethyl-mercaptan) and natrium diethyl dithiocarbamate. These compounds did not influence the toxicity of resorcinol. Cysteine and oxidized glutathione did not prevent the action of p-benzoquinone and polyphenols. Addition of ethyl-mercaptan, cysteine, and ascorbic acid considerably increased the survival of Dunaliella in hydroquinone solutions. Presence of saccharose and natrium salt of adenosine triphosphoric acid did not influence the toxic action of p-benzoquinone and polyphenols on aquatic plants. (Steiner-Mass)
W80-02331

5G. Water Quality Control

SURVEY RESULTS ON THE BENEFITS OF WATER POLLUTION ABATEMENT IN THE MERRIMACK RIVER BASIN,
Yale Univ., New Haven, CT. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W80-02004

SAFE DRINKING WATER: CURRENT AND FUTURE PROBLEMS - PROCEEDINGS OF A NATIONAL CONFERENCE IN WASHINGTON, D.C.
For primary bibliographic entry see Field 6D.
W80-02027

MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX I: PLAN FORMULATION.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5D.
W80-02037

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX II: COMMENTS.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5F.
W80-02038

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX III: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Haven and Emerson Ltd., Cleveland, OH.
For primary bibliographic entry see Field 5D.
W80-02039

WASTEWATER, MANAGEMENT STUDY, FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX VII: INSTITUTIONAL EVALUATION.
Linton and Co., Inc., Washington, DC.
For primary bibliographic entry see Field 5D.
W80-02040

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS. IX: AGRICULTURAL EVALUATION.
Ohio Agricultural Research and Development Center, Columbus.
For primary bibliographic entry see Field 5D.
W80-02041

WASTEWATER MANAGEMENT ALTERNATIVES FOR THE CLEVELAND-AKRON, THREE RIVERS WATERSHED AREA: TECHNICAL APPENDIX-PHASE I: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5D.
W80-02042

TREATMENT TECHNOLOGY TO MEET THE INTERIM PRIMARY DRINKING WATER REGULATIONS FOR ORGANICS: PART 4,
Environmental Monitoring and Support Lab., Cincinnati, OH. Physical and Chemical Methods Branch.
T. J. Sorg.
American Water Works Association Journal, Vol 71, No 8, p 454-466, August 1979.

Descriptors: *Mercury, *Chromium, *Drinking water, *Treatment, *Waste water treatment, *Pollutants, *National interim primary drinking water regulations, *Water pollution, *Chemical control, *Chemical wastes, *Toxic chemicals, Treatment methods, Conventional coagulation, Lime softening, Ion exchange, Activated carbon, Reverse osmosis, Electrodialysis, Water pollution sources, Toxicity, Public health.

The author describes current treatment methods for removing chromium and mercury from drinking water in order to meet the inorganic National Interim Primary Drinking Water Regulations. Chromium readily induces skin sensitizations and the hexavalent form produces lung tumors when inhaled, but the amount of chromium that can be ingested over a lifetime without producing adverse health affects is still virtually undetermined. Because chromium is utilized either directly or indirectly in many manufacturing processes, treatment techniques to remove or recover chromium from industrial wastewater have been well developed and documented. For the treatment of drinking water few studies have been reported because chromium has not been a serious problem. Various treatment methods are conventional coagulation, lime softening, ion exchange, activated carbon, reverse osmosis and electrodialysis. Mercury is a very toxic chemical and the chances of mercury occurig in drinking water have greatly increased over the last decade. Mercury occurs in inorganic and organic forms, both of which are toxic to humans. Mercury poisoning is characterized mainly by neurological symptoms and leads to permanent damage or death. The mercury treatment techniques studied most extensively have been conventional coagulation, lime softening and activated carbon. Ion exchange and reverse osmosis have also been investigated to a lesser degree. Presently, mercury is not a problem in drinking water although there are signs that the detection frequency is increasing. (Iervolino-NC)
W80-02043

EMISSIONS FROM IN SITU BURNING OF CRUDE OIL IN THE ARCTIC,
Tornoto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5C.
W80-02061

SALTWATER-BARRIER LINE IN FLORIDA: CONCEPTS, CONSIDERATIONS, AND SITE EXAMPLES,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. L. Hughes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-101306, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-75, 1979. 29 p, 26 Fig, 1 Tab, 32 Ref.

Descriptors: *Saline water intrusion, *Canals, *Groundwater, *Saline water barriers, *Water quality control, Florida, Coasts, Flow control, Dams, Gates, Streamflow, Channel improvement, Water table, Aquifers, Evaluation.

Construction of canals and enlargement of streams in Florida has been mostly to alleviate impact of floods and to drain wetlands for development. Land drainage and heavy pumpage from coastal water-table aquifers has degraded potable ground and surface water with saltwater. Control of saltwater intrusion is possible through implementation of certain hydrologic principles. State of Florida statute 373.033 provides for a saltwater-barrier line in areas of saltwater intrusion along canals. A saltwater-barrier line is defined as the allowable landward limit that a canal shall be constructed or enlarged or a stream deepened or enlarged without a salinity-control structure seaward of the saltwater-barrier line. The salinity control structure controls saltwater intrusion along a surface-water channel and assists in controlling saltwater intrusion into shallow aquifers. This report briefly reviews the fundamentals of saltwater intrusion in surface-water channels and associated coastal aquifers, describes the effects of established saltwater-barrier lines in Florida, and gives a history of the use and benefits of salinity-control structures. (Woodard-USGS).
W80-02237

EFFECTS OF PEAT UTILIZATION ON WATER QUALITY IN MINNESOTA,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
For primary bibliographic entry see Field 6G.
W80-02327

MULTIPLE JETS IN SHALLOW FLOWING RECEIVING WATERS,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-02344

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

OPTIMAL ALLOCATION OF REGIONAL WATER RESOURCES,
Danish Inst. of Applied Hydraulics, Copenhagen.
T. Jonch-Clausen.
Nordic Hydrology, Vol 10, p 7-24, 1979. 8 Fig, 26 Ref.

Descriptors: *Optimization, *Planning, *Water resources development, *Methodology, Quadratic programming, Cachela Poudre River(CO), Colorado, Seasonal, Resource allocation, Model studies, Algorithms, Input-output analysis, Systems analysis, River basin development, Optimum development plans, Water supply, Water demand, Treatment facilities, Inter-basin transfers.

A methodology for regional water resources planning includes hydrologic as well as economic system inputs and has an iterative quadratic programming approach which handles larger-scale problems without overly complex mathematical techniques. The basic element of the methodology is a single-period, single-objective allocation model in which a nonlinear (concave) total cost function is minimized subject to a set of linear system constraints. An input-output framework brings the economic optimization together with the hydrologic context. The basic planning model is extended to include cost uncertainty and also deals with seasonal variations of water demand and supply in a dynamic framework. The methodology is applied to the Cache la Poudre River basin in Northern Colorado. Results show that presently available water supplies in the basin will be adequate in the year 2000, but by 2020, the water supply will be overextended requiring new transbasin water transfer projects. Regional sewage treatment facilities are also favored as increased economies of scale take hold. (Luedtke-Wisconsin)
W80-02006

BENEFITS OF POLLUTION CONTROL,
Bowdoin Coll., Brunswick, ME. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W80-02130

BENEFITS OF WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis. Dept. of Agricultural and Resource Economics.
For primary bibliographic entry see Field 6B.
W80-02131

WATER RESOURCES OF THE PORT MADISON INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
W. E. Lum, II.
Geological Survey Water-Resources Investigations 78-112 (open-file report), 1979. 73 p, 9 Fig, 1 Plate, 10 Tab, 16 Ref.

Descriptors: *Available water, *Groundwater resources, *Streams, *Water quality, * *Water supply, Indian +reservations, Streamflow, Aquifer characteristics, Water yield, Groundwater availability, Projections, Test wells, Saline water intrusion, Evaluation, Washington, *Port Madison Indian Reservation(Wash).

The study summarized in this report was made to provide Suquamish Tribal leaders with information on the reservation's surface- and ground-water resources. The Tribal leaders need this information to help manage and protect their water resources against over-development. The quantity of ground water estimated to be available for withdrawal on a long-term basis is about 600 million gallons per year in the western part of the reservation and 400 million gallons per year in the eastern part of the reservation. It should be possible, economically and practically, to capture at least 40 percent of this ground water with properly constructed and located wells before it is discharged into the sea. This is enough water to supply at least 5,000 and 3,500 people with domestic water in these respective areas--about four times the present population. Of nine stream sites that were studied, the lowest average streamflows for a 7-day period estimated to occur an average of once in 2 years were 1.3 cubic feet per second or less. Streams at three of the sites have been observed dry at least once. The short period of data collection during this study limits the accuracy of statistical estimates of low flows. Both surface and ground water are of good quality with no unusual or harmful constituents; there was no evidence of major pollution in 1977. In the future, seawater intrusion into the groundwater system and pollution of the surface water by improperly treated sewage waste water could become problems. (Woodard-USGS).
W80-02231

MODEL EVALUATION OF THE HYDROGEOLOGY OF THE CYPRESS CREEK WELL FIELD IN WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
P. D. Ryder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111081, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-79, October 1978. 68 p, 36 Fig, 3 Tab, 13 Ref.

Descriptors: *Hydrogeology, *Model studies, *Simulation analysis, *Potentiometric level, *Florida, Groundwater resources, Aquifer characteristics, Water wells, Water supply, Pumping, Groundwater movement, *Floridan aquifer, *Cypress Creek well field, West-central Florida.

The Cypress Creek well field is being developed to help supply a rapidly growing population in west-central Florida. The ground-water system in the Cypress Creek well-field area consists of a surficial sand aquifer, a semiconfining clay layer ranging from 2 to 25 feet in thickness, and a sequence of carbonate rocks, approximately 1,000 feet thick, called the Floridan aquifer. All recharge to the Floridan aquifer in the local area is derived from the overlying surficial sand aquifer by downward percolation through the semiconfining clay bed. The major proportion of water supplied to municipal wells open to the Floridan aquifer comes from a dolomitic section of the Avon Park Limestone containing two major cavernous zones. The hydrogeology of the well-field area was evaluated by digital model simulation. Model runs were made to analyze sensitivity of the model to variations in selected hydrologic parameters. The model was tested further by attempting to simulate the potentiometric surface of the Floridan aquifer under actual pumping stresses during the January 1976 dry period. (Woodard-USGS).
W80-02236

WETLAND DEVELOPMENT, AN ALTERNATIVE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
C. J. Kirby.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 139-142, 1978.

Descriptors: *Wetlands, *Developed waters, *Dredging, *Federal government, Administrative agencies, Water management(Applied), Water resources development, Aquatic plants, Ecological effects, On-site investigations, Preservation, Economics, Feasibility, Project planning.

The Dredged Material Research Program of the United States Army Engineer Waterways Experiment Station has demonstrated that wetlands development utilizing a suitable fill material, such as dredged material, as a substrate offers a solution to dredged material disposal and wetland losses that is feasible from a biological, engineering, and economic standpoint. Field studies around the United States have demonstrated that wetlands can be successfully developed, and these wetlands appear to function in the same manner as natural systems. Field implementation has begun on a small-scale, routine basis for either mitigation or aesthetic purposes. The information gained through this research effort is being used by state agencies to reestablish wetlands previously destroyed or filled. (See also W80-02253) (Howard-Mass)
W80-02277

6B. Evaluation Process

THE POTENTIAL OF ECONOMIC DESALINIZATION FOR SMALL SYSTEMS,
URS Corp., San Mateo, CA.
M. Staackmann, and F. J. Agardy.
Journal of American Water Works Association, Vol 69, No 7, p 344-347, July 1977. 3 Fig, 1 Ref.

Descriptors: *Cost-benefit analysis, *Hardness(water), *Desalination, *Southwest U.S., *Cities, Benefits, Costs, Desalination processes, Economics, Population, Water supply, Water costs, Water quality, Industries, Size, Dissolved solids, Salts, Economic justification, Economic feasibility.

Benefit-cost projections of small scale desalination plant use for improving marginal water quality supplies in western US states indicate that small populations cannot show benefit-cost advantage although medium population communities have favorable projections with a minimum level of industry. Large population communities have favorable benefit-cost ratios, except where existing water quality is marginally brackish, below 1000 mg/l TDS and 500 mg/l total hardness. The population range of investigated communities is 500-100,000. Only benefits which can be economically quantified such as use of household softeners, cleaning products, water heater life expectancy, and bottled water consumption, are included. By improving water supply, a major benefit (community) is the possibility of increasing its industrial base. Communities smaller than 700 population almost entirely fall out of feasibility projections. For communities with 700 population, with 3000 mg/l TDS and 750 mg/l hardness, a benefit-cost ratio advantage depends on the amount of industry. In communities with no industry, improving water quality is not economically justified. With light and medium industry, using 25% and 50% water use, respectively, benefit-cost ratios are favorable for a wide range of improved water quality, however, improving water with only 750 mg/l TDS is unfavorable regardless of industry makeup. (Danovich-Wisconsin)
W80-02001

THE ECONOMICS OF THE OCEANS: ENVIRONMENT, ISSUES, AND ECONOMIC ANALYSIS,
Columbia Univ., New York. Graduate School of Business.
M. Wilkinson.
The American Economic Review, Vol 69, No 2, p 251-255, 1979. 8 Ref.

Descriptors: *Economics, *Oceans, *Policy, *Resources development, *Management, *International waters, Fisheries, Gas, Oil, Shipping, Minerals, Evaluation, Extended economic zone, Exploitation, Cost-benefit analysis, Alternative planning, Coastal zone, Decision making.

The changing ocean environment, ocean policy issues, and certain areas of economic theory and measurement most relevant to ocean economics are reviewed. Almost all economic policy issues involve design of a regulatory mechanism to promote more rational management of ocean resources. Currently, the most serious policy issues in the extended economic zones concern fisheries, coastal zone management, and petroleum. Principal fisheries issues are: (1) formulation and analysis of bioeconomic mode of multispecies fisheries; (2) characteristics of supply functions for individual fisheries; (3) costs and benefits of regulating fisheries; and (4) the organization, structure, and political effectiveness of the fishing industry. Management problems in the petroleum and coastal zone

management include a lack of analysis of the allocative implication of alternative bidding schemes, the small number of private companies involved, and the proprietory nature of information regarding petroleum fields. Economic policy issues outside the extended economic zones are deep sea mining, shipping, pollution from ships, fishing for migratory species, and military uses. Usefulness of the theory of economic externalities or public commodities and the optimal control of natural resources as management tools is discussed. The shortage of empirical research reflecting a lack of biological knowledge means that policy decisions are resolved without estimates of the economic benefits and costs of alternative courses of action. (Luedtke-Wisconsin)
W80-02002

SURVEY RESULTS ON THE BENEFITS OF WATER POLLUTION ABATEMENT IN THE MERRIMACK RIVER BASIN,
Yale Univ., New Haven, CT. Dept. of Economics.
S. Oster.
Water Resources Research, Vol 13, No 6, p 882-884, December 1977. 3 Tab, 3 Ref, 1 Append.

Descriptors: *Cost benefit analysis, *Willingness-to-pay, *Surveys, *Water quality control, Costs, Benefits, Income, Financing, Cost-benefit ratio, Economic efficiency, Water use, Recreation, Pollution abatement, River basins, Merrimack River Basin(NHMA), New Hampshire, Massachusetts, Federal Water Pollution Control Act Amendments of 1972, Waste water treatment, PL 92-500, Industrial wastes, Municipal wastes.

Benefits of water quality improvement in the extremely polluted Merrimack River Basin are estimated from a frequency-of-use/willingness-to-pay survey of basin residents in 1973 in an attempt to determine whether economic benefits mandated by the Federal Water Pollution Control Act amendments of 1972 justify the cleanup costs. Data were collected from 200 residents on their willingness-to-pay, on their expected use of a clean river, and on certain socioeconomic attributes. Average willingness-to-pay for river quality improvement is slightly over $12.00 per year per person, and the median number of days respondents expect to use the clean river is 13 days per year. Both willingness-to-pay and frequency of use increases with income. Computing the annual cost of cleaning up the basin, assuming a lifetime of 20 years and a discount rate of 7%, per capita costs in most of the communities will be less than $12, indicating that aggregate benefits justify costs for the geographic area. However, this favorable cost-benefit ratio does not hold for all groups of the population since willingness-to-pay is influenced by income. If local cleanup costs are financed through a combination of user charges and property taxes as is now the case, the cost-benefit ratio for low income people may be less than 1, suggesting that financing techniques should better accomodate the relationship between benefits and income. (Luedtke-Wisconsin)
W80-02004

DEEP SEABED MINING AND DEVELOPING COUNTRIES: CONSIDERATION OF DISTRIBUTIONAL FACTORS,
United Nations Development Program, Rangoon (Burma).
M. J. Cruickshank.
Marine Technology Society Journal, Vol 13, No 2, p 5-9, 1979. 1 Tab, 11 Ref.

Descriptors: *Developing countries, *Governmental interrelations, *Manganese nodules, *International waters, *Distribution, *Deep sea mining, Economics, Economic impact, Governments, Metals, Pacific Ocean, Zaire, Political aspects, Water policy, Mineral industry, Mining, Optimization, Production, Profit, Benefits, Water pollution, Manganese, Copper, Cobalt, Nickel.

Major arguments for or against deep seabed mineral development are both unsubstantiated benefits accrue to both industrial and developing countries by early production, given an appropriate policy. Industrialized countries see nodule deposits as a source of strategic minerals presently in short supply domestically. Developing country producers of metals present in nodules think seabed production encroaches on their existing markets. However, strategic metal supplies for industrialized countries from ocean-based mines are militarily vulnerable in times of hostility; and the US payment surplus balance is not necessarily beneficial to world economy. However, at projected production rates, no individual market is substantially affected. For example, Zaire annually produces 500,000 tons of copper (Cu), 400,000 tons manganese ore (Mn), and 1,500 tons of cobalt (Co), representing 83%, 2%, and 5% of Zaire's exported production. If total seabed production is applied against Zaire's total exported production, 33,000 less tones of Cu, all Mn, and all Co exports would cease. This amounts to $100,000 million, or 3% of Gross Domestic Product; it does not significantly affect wealth distribution in Zaire, although it significantly affects their mine workers. Profit distribution from common heritage under existing regimes incurs no benefits to those most in need. Due to technical and environmental constraints, it is also unlikely that huge profits from seabed mining would accrue. (Danovich-Wisconsin)
W80-02010

BIOECONOMIC MODELS OF MARINE RECREATIONAL FISHING,
Rhode Island Univ., Kingston. Dept. of Resource Economics.
K. E. McConnell, and J. G. Sutinen.
Journal of Environmental Economics and Management, Vol 6, No 2, p 127-139, June 1979. 2 Fig, 1 Tab, 23 Ref.

Descriptors: *Optimization, *Sport fishing, *Marine fisheries, *Commercial fishing, *Fish management, *Mathematical models, *Recreation demand, *Social behavior, *Fisheries, Economics, Exploitation, Fish populations, Fish harvest, Fish, Equations, Competition, Curves, Social aspects, Management.

A bioeconomic model shows that marine sport fishing under open access results in too much fishing; unregulated ocean use by recreational fishers induces an economically inefficient allocation of resources. The 1970 recreational catch weighed 1.58 billion pounds; commercial finfish catch weighed 3.87 billion pounds. About 29% total weight of landed fish is recreational. An analytical model is developed which accounts for interdependence between present catch and future fish stock levels. In fisheries exploited by both commercial and recreational fishers under open access, the critical allocation parameter is the price elasticity of effort in each fishery. Recreationists fish primarily for fun rather than money. The model includes conditions for determining optimal recreational effort when recreational fishers supplement their income with their catch, when a small proportion of fishing population accounts for large catch proportion, and when catch rates differ from kill rates because anglers throw back a fraction of all fish caught. (Danovich-Wisconsin)
W80-02013

UTILIZATION OF ENVIRONMENTAL KNOWLEDGE FOR WATERSHED MANAGEMENT IN NORTHERN MICHIGAN,
Michigan Univ., Ann Arbor. Inst. for Social Research.
D. C. Pelz, and J. E. Gannon.
Environmental Management, Vol 3, No 2, p 113-121, 1979. 1 Fig, 10 Ref.

Descriptors: *Social aspects, *Public participation, *Water management(Applied), *Environmental management, *Lakes, *Water quality, *Watershed management, *Lake management, Michigan, Governments, Quantitative data, Qualitative data, Planning, Decision making, Wetlands, Aquatic impacts.

This report presents information gathered from a study conducted by the University of Michigan's Biological Station of the aquatic and human resources of the resort-oriented northern lower Michigan area. An area rich in water resources, this part of Michigan is beginning to feel the pressures of increasing population and resource use. The study attempted to differentiate between the gathering of 'hard' information (quantitative data) and 'soft' information (such as quality of life). Results were directed toward long-term environmental management. Research was conducted between 1972 and 1976 and included meetings with selected leadership groups, attendance at planning commission meetings and personal contacts. Information was disseminated in various ways, including a series of reports and 'information packages,' articles in local newspapers and reports over radio and TV. Illustrative examples are presented in which hard or soft information prepared by the Biological Station resulted in instrumental or conceptual use. These include a fish hatchery discharging into Crooked Lake; an ordinance to protect wetlands in Burt Township; planning for sewer systems in three lake areas; and freeway planning in one county. It is recognized that a longer time frame is needed for effective action by local groups in their approach to growth/resource management. Mutually reinforcing channels of communication should be employed to develop a climate of receptiveness and understanding to ensure environmentally sound decisions. (Arnold-NC)
W80-02022

SOME WATER RESOURCE POLICY CONSIDERATIONS,
Texas Univ. at Austin. Center for Research in Water Resources.
L. R. Beard.
Water Supply & Management, Vol 3, No 3, p 173-177, 1979.

Descriptors: *Water resource management, *Water policy, *Planning, *Economics, *Discount rates, *Multiple objective planning, *Value, *Rational formula, Investments, Project benefits, Assessments, Social values, Decision making, Project planning, Benefits.

The author questions water resource policy changes in the United States in relation to their impact on public welfare and on the democratic nature of the U.S. system of government. Multiple objective evaluations are seen to be unscientific and socially destructive when they fail to express the relative values of various objectives in terms of the general welfare. The author states that the use of unwarrantedly high discount factors for estimating the present values of future benefits strongly supports the type of project that is of transitory value and discourages the development and preservation of resources for the benefit of future generations. To avoid the pitfalls of multiple objectives concept, all project benefits need to be expressed in common terms in order to permit determination of an optimun management plan. Through this, multiple objective planning reverts properly to single objective planning and scientific methods can be applied to the solution of water resources management problems. Conclusions indicate that the most reasonable financial discount rate usable for planning is the difference between the interest rate in long-term government investments and the rate of inflation, which should be supplemented by discounts due to expected changes in technology and expected changes in social values. Proper implementation of a comprehensive economic system of values can expedite proper management of resources, greatly reduce costs and increase benefits and truly will build for the benefit of future generations as well as for the present. (Iervolino-NC)
W80-02026

SAFE DRINKING WATER: CURRENT AND FUTURE PROBLEMS - PROCEEDINGS OF A NATIONAL CONFERENCE IN WASHINGTON, D.C.
For primary bibliographic entry see Field 6D.
W80-02027

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: MAIN REPORT.
California Region Framework Study Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 169, Price codes: A13 in paper copy, A01 in microfiche.

Prepared for the Pacific Southwest Inter-Agency Committee, Water Resources Council, May 1972, 293 p, 23 Fig, 22 Tab, 15 Maps.

Descriptors: *Water resources development, *Resources development, *Multiple purpose projects, *Regional development, *Water resources, *California, *Oregon, *Planning, *Institutions, *Water supply, Economics, Navigation, Flood control, Recreation, Agriculture, Water quality, Fish management, Wildlife management, Environmental effects, Natural resources, Cost/benefit analysis, Social aspects, Administration.

This report, prepared under the guidance of the U.S. Water Resources Council, outlines alternative uses of water and related land resources for the California Region between 1965 and 2020. The area comprises all of California and 7% of Oregon and is divided into 11 subregions. Section A summarizes the findings of the 18 separate appendices of the study. By 2020 the area's population will be about triple that of 1965. The report considers a whole array of problems, including agricultural, industrial and domestic water supply; irrigation, drainage and electric power; flood control, water quality, watershed management and recreation. Regional characteristics and a study of the region's economy are presented. Although agriculture is still the dominating industry, the manufacturing and service industries are growing rapidly. Recommendations include the provision of regionwide flood damage and shoreline erosion management programs, more and better water quality management planning, and better intraregional coordination in planning. Section B describes the various economic needs of the region within the context of resource conservation and development, and presents a framework plan and an action plan to serve as a guide for the management, use and development of the region's water and related land resources. The action plan considers the goals of best use of resources and satisfying future needs and includes provisions for development of resources with minimal impact on the natural environment, continuation of major water supply development projects, use of geothermal energy, reduction of irrigation, shoreline development and protection measures. (Arnold-NC)
W80-02033

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX IX-FLOOD CONTROL.
California Region Framework Study Committee.
For primary bibliographic entry see Field 4A.
W80-02034

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX XVI-SHORELINE PROTECTION AND DEVELOPMENT.
California Region Framework Study Committee. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 170, Price codes: A12 in paper copy, A01 in microfiche. Prepared for Pacific Southwest Inter-Agency Committee, Water Resources Council, June 1971. 271 p, 5 Tab, 9 Maps, 3 Supplements, 30 Ref.

Descriptors: *Water resources development, *California, *Shores, *Beaches, *Coasts, *Shore protection, *Shore erosion, *Multiple purpose projects, *Oregon, Planning, Structural measures, Nonstructural measures, Land use, Recreation.

This appendix is part of a larger study undertaken to evaluate alternative water and related land resources for the California Region, an area consisting of California and 7% of Oregon. This appendix presents an evaluation and planning proposals for shoreline protection and development in the Region. A description of the region is presented. A regional summary of needs is followed by a more detailed analysis of shore-line data from the region's 11 subregions. The coastal shoreline of the area is generally a rugged, mountainous one, with a very temperate climate. Major land uses of the 1,349 mile shoreline are urban, agricultural, military, public reserves, and harbors. Owership is about 70% private; and 30% public. About 26% of the shoreline is critically eroding and requires further protection. Structural measures to protect the shoreline emphasize the urban and public recreation areas being threatened with critical erosion, and on the development of new sandy beaches. Proposed structural measures include seawalls, beach replenishment and stabilization. Non-structural measures include management programs for all public land and, by 2020, 70% of previously unmanaged private land. Estimated costs for these measures are approximately $187 million. Conclusions indicate that opportunities for recreation use of the shoreline--especially swimming--are too limited, and that substantial portions of the shoreline are subject to critical erosion. Recommended are replenishment of beach areas, beach stabilization, acquisition of sufficient rights-of-way to ensure access to public beaches, and more extensive data collection programs. (Arnold-NC)
W80-02035

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX XVII-NAVIGATION.
California Region Framework Study Committee.
For primary bibliographic entry see Field 6D.
W80-02036

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX II: COMMENTS.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5F.
W80-02038

WASTEWATER, MANAGEMENT STUDY, FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX VII: INSTITUTIONAL EVALUATION.
Linton and Co., Inc., Washington, DC.
For primary bibliographic entry see Field 5D.
W80-02040

BENEFITS OF POLLUTION CONTROL,
Bowdoin Coll., Brunswick, ME. Dept. of Economics.
A. M. Freeman, III.
In: Critical Review of Estimating Benefits of Air and Water Pollution Control, Report No EPA-600/5-78-014, p II-1-II-55 June 1978. 3 Fig, 19 Ref. 1 HA 094 68-01-2821.

Descriptors: *Pollution abatement, *Benefits, *Air pollution effects, *Water pollution control, *Methodology, *Alternative planning, Policy, Evaluation, Research priorities, Public health, Recreation, Analytical techniques, Measurement, Estimating, Economics, Water pollution effects, Cost-benefit analysis, Theoretical analysis.

Economic theory and analytical techniques for estimating national benefits of air and water pollution control are generally well-developed, except for health and life benefits, but empirical data is seriously deficient. Published estimates do not make adequate use of available analytical techniques and data, though the cost of using such resources would be relatively small. Recommendations are given for gathering additional data and for more effective use of existing data. For estimating health and property value benefits of air pollution control, both a consistent framework and language for expressing uncertainty in probabilistic terms exist. In the case of water pollution, however, medical knowledge of health benefits is inadequate, as is the data base for relating water quality changes to recreational use changes, and at present reasonable estimates of water pollution control benefits are not possible. Economists' efforts to assign values and estimate benefits in the areas of mortality, morbidity, and vegetation and materials damages from air pollution, and sport and commercial fisheries and production benefits from water pollution control must await better information on physical effects. The Lave and Seskin air pollution-mortality regression equations and the Freeman-Rosen property value estimating technique are recommended. (Lynch-Wisconsin)
W80-02130

BENEFITS OF WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis. Dept. of Agricultural and Resource Economics.
J. B. Stevens.
In: Critical Review of Estimating Benefits of Air and Water Pollution Control, Report No EPA-600/5-78-014, p IV-1-IV-39, June 1978. 2 Fig, 22 Ref, 2 Append. 1 HA 094, 68-01-2821.

Descriptors: *Water pollution control, *Cost-benefit analysis, *Benefits, *Welfare(Economics), *Recreation demand, *Willingness to pay, Water pollution effects, Methodology, Model studies, Mathematical models, Public benefits, Monitoring, Environmental Protection Agency, Estimating, Option demand, Public health, Property values, Damage functions, Simulation analysis, Aesthetics, Policy, Planning, Economics, Attitudes, Social aspects, Recreation.

Very little precise knowledge exists of how much economic benefit would result from achieving state and federal water quality standards, despite the richness of literature on applied welfare-economics and benefit-cost analysis. Estimates of production losses (including waterborne disease) are adequate. But most potential benefits appear to be in the areas of recreation, aesthetics, and option demands, where methodologies for simulating consumers' willingness to pay for improvements are underdeveloped. Lack of adequate, generalizable behavioral relationships between water quality and consumer behavior is the predominant problem in assessing pollution control benefits. The U.S. Environmental Protection Agency should expand its role in generating studies of consumption benefits specifically designed to be extrapolated to the national level, and should establish a long-term behavioral monitoring system in which common socio-economic and physical data sets can be maintained at sites where water quality changes are occurring. Two recreational models are appended: (1) in which a recreationist has separate demand functions for two nonpriced sites having some degree of substitutability; and (2) in which the two recreation sites are considered by the recreationist as perfectly substitutable, but which have different travel costs. A reduction-in-travel-cost model may assist in assessing recreation benefits at a higher level of aggregation than is currently possible. (Lynch-Wisconsin)
W80-02131

SHOULD YOU BUY NOW. THE IMPACT OF INFLATION ON POLLUTION CONTROL EXPENDITURES,
De la Rue (Robert E.) Associates, Santa Clara, CA.
R. E. De la Rue.
Pollution Engineering, Vol 10, No 10, p 42-43, October 1978. 3 Tab.

Descriptors: *Costs, *Pollution abatement, *Inflation(economic), *Treatment facilities, Regulation, Economics, Waste water treatment, Cities, Water pollution, Water pollution control, Appropriation, Priorities, Federal government, Federal Water Pollution Control Act Amendments of 1972(PL 92-500), Legislation, Adjusted costs.

Although both government and industry have spent billions for air and water pollution control since the 1960's, additional capital expenditures exceeding $100 billion is needed to meet expanded goals; reasons for these large capital investments and future projections are stricter regulations and inflation. Inflation is expected to continue. Communities should, therefore, build the remaining municipal wastewater treatment plants as soon as possible. Delays will be costly, and many more municipalities will have difficulties raising their fund share, adding to the tax burden on citizens and industry, and increasing waste water treatment costs through high charges to users. Government inaction and delays, especially in the municipal wastewater treatment construction program, have been costly. The 1972 Water Pollution Control Act Amendments authorized $18 billion over fiscal

1973-1975, for wastewater treatment construction. Unfortunately, fund authorization does not mean appropriation or actual outlay. Municipal wastewater treatment construction grant program totals for 1957-1977 are $34 billion authorization, $26.9 billion appropriation, $25.3 billion obligation, and $12.9 billion outlay. Actual outlays total one-half obligations. The purchasing power of the dollar has decreased 31% since 1973; therefore, $18 billion authorization buys only $12.4 billion at 1978 costs. If $5 billion is authorized and actually obligated each year from 1978-1986, totaling $45 billion, the actual purchasing power at 5.5% inflation is only $36.7 billion. (Danovich-Wisconsin)
W80-02135

LEAK DETECTION: MODERN METHODS, COST, AND BENEFITS,
East Bay Municipal Utility District, Oakland, CA.
G. L. Laverty.
Journal American Water Works Association, Vol 71, No 2, p 61-64, 1979.

Descriptors: *Leakage, *Water conservation, *Utilities, *Water loss, *Oakland(CA), *Benefit-cost ratio, Water resources, Water supply, Water works, Public utilities, Costs, Benefits, Management, Pipes, Pipelines, Water districts, Water costs, Water conveyance, Water management(applied), Administration, Economics, Equipment, Electronic equipment, Surveys.

Leak location and repair programs conducted by the East Bay Municipal Utility District (EBMUD), Oakland, California, require slightly increased expenditures, but these are offset by resource savings. Savings from leak detection and repair programs will increase in the future, as electrical, chemical, and construction costs skyrocket while water resources dwindle. EBMUD's program involves two 2-person crews equipped with portable devices which detect sounds from a leak while filtering out most spurious noises. Program results are significant. A large leak, located and repaired on a 16-in pump line discharging water underground into a cracked ceramic storm drain, amounted to 0.36 L/s (60 gpm) in a high head pump zone with significant electrical energy loss. Over three years, the district reduced distribution system 'demand' caused by water losses by 2.5% which is over 6800 ML (1.8 bil gal)/yr. At an average 385 repairs/yr, EBMUD repaired $90,000 worth of leaks/yr, resulting solely from the survey program. Toilet tank and irrigation system leaks are the most common customer leak sources. Repaired customer leaks account for 25% of identified and repaired distribution leaks, an additional 4 ML (1 mil gal) per day. Program gross direct cost is $150,000/yr or 0.8% of the operations and maintenance budget. Specific benefits include conservation of aqueduct, filter plant, and pumping plant capacity; power and chemical savings; and water savings in drought years. (Danovich-Wisconsin)
W80-02136

A DO-IT-YOURSELF LEAK SURVEY BENEFIT-COST STUDY,
Los Angeles City Dept. of Water and Power, CA.
W. L. Kingston.
Journal of American Water Works Association, Vol 71, No 2, p 70-72, 1979. 3 Fig.

Descriptors: *Water works, *Surveys, *Cost-benefit ratio, *Los Angeles(CA), *Leakage, Water supply, Utilities, Public utilities, Economic justification, Economics, Water costs, Operating costs, Maintenance costs, Equipment, Electronic equipment, Pipes, Pipelines, Water loss, Water conservation.

During a major drought in California 1976-77, pipeline leaks in Los Angeles were surveyed as a conservation measure; program continuation is justified by economic and conservation data, using benefit-cost analysis. This benefit-cost analysis can help other water utilities determine whether a pipeline survey provides economic savings. The program consists of a two-person leak survey crew equipped with electronic sounding equipment. When a leak is found in the system, its exact position is determined and repair orders are written. If a leak is heard on private property, the customer is notified. Benefits include the value of water saved; deferred construction of new facilities; preventing property damage; refutation of claims and law suits; improved meter reading; improved public relations; savings in leak repair crew time due to accurate leak location; and postponement of time-of-day power charges in pumped service zones. Costs include leak repair, crew's labor, and equipment operation, maintenance, and depreciation. Water managers are the best judges of benefit-cost factors that apply to their particular system. (Danovich-Wisconsin)
W80-02137

THEORETICAL AND EMPIRICAL CONSIDERATIONS FOR ESTIMATING CAPACITY AND CAPACITY UTILIZATION IN COMMERCIAL FISHERIES,
Florida Agricultural Market Research Center, Gainesville.
F. J. Prochaska.
American Journal of Agricultural Economics, Vol 60, No 5, p 1020-1025, December 1978. 9 Ref.

Descriptors: *Commercial fishing, *Fish harvest, *Fish management, *Theoretical analysis, *Fishery Conservation and Management Act, Fisheries, Economics, Regulation, Legislation, Industries, Economic efficiency, Prices, Investment, Elasticity of demand, Production, Fish populations, Fish conservation, Fishing gear.

This paper addresses the theoretical construct of capacity, methodological problems in empirical measurement, and capacity measures used in some fishery management plans in response the 1976 Fishery Conservation and Management Act requirements. Capacity and capacity-utilization levels--with particular reference to developing fishery management plans--depend on input prices, physical productivity, and activities and constraints in the market and processing sectors which are transmitted to harvesting sectors through the pricing system. Capacity represents the physical output level that a firm or industry is capable of producing with existing plant and equipment; it is based on long-run considerations of expected prices and costs. The rate at which capacity is utilized, however, is more flexible and can be changed in response to short-run changes in price, costs and other conditions. The most important problems in capacity estimation are related to a lack of basic research and data, complexities of multiple-species fisheries, production seasonality, and unknowns in production, processing, and marketing under-utilized species. Several presently proposed plans such as the Northwest Atlantic Herring Fishery Plan, Gulf of Alaska Ground Fish Plan, and Northern Anchovy Fishery Plan are commendable since they consider economic factors throughout the system. (Danovich-Wisconsin)
W80-02141

GRAZING MANAGEMENT OF PLANT RESOURCES IN EASTERN SENEGAL AS INFLUENCED BY WATER DEVELOPMENT,
Texas A and M Univ., Vernon. Research and Extension Center.
P. W. Jacoby, Jr.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech University, Lubbock, p 655-660, July 1979, 5 Ref.

Descriptors: *Grazing, Management, *Carrying capacity, *Water resources development, *Range, Management, *Planning, Arid lands, Social aspects, Economic aspects, Administrative constraints, Institutions, Livestock, Vegetation, Senegal.

Grazing management in relation to water development in arid eastern Senegal is analyzed here as only a portion of a complicated project involving the socioeconomic, funding, development of infrastructures and numerous other problems of range and livestock improvement in the area near the confluence of the Senegal and Faleme Rivers. A division of the study area into eight management units based upon traditional use patterns and natural ecological boundaries on a best-fit basis with the information available, indicated that in order to achieve a sound basis of grazing consistent with the resources developed, a system of continuous moderate use for annual type vegetation will have the best chance of success for implementation. A balance between the forage and water resources based on annual rainfall rather than deep wells will help achieve the goal of balancing animal units with forage production. It is unfortunate that large water developments have resulted in overuse and abuse of the forage resources in many development projects in Africa, so that careful studies of local situations are necessary if technologies are to be chosen which have the best chance of adaptation. (Tickes-Arizona)
W80-02201

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
For primary bibliographic entry see Field 6E.
W80-02253

WETLAND VALUES,
Connecticut Coll., New London.
W. Niering.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 7-8, 1978. 6 Ref.

Descriptors: *Wetlands, *Value, *Land use, *Water resources development, Pollution, Productivity, Groundwater recharge, Flood protection, Sedimentation, Federal government.

The values of wetlands to man include pollution filtration, a potential for high productivity, ground water recharge, flood control, storm buffering, sediment accretion, and high levels of energy conservation. Incentives at the Federal level must be developed to assist states and local communities in wetland preservation. The multiple use role that wetlands serve in their natural state should be recognized. An inventory is necessary to aid in the preservation of the diversity of wetland types found in the United States. (See also W80-02253) (Howard-Mass).
W80-02255

VALUE OF WETLANDS AS DOMESTIC ECOSYSTEMS,
Florida Univ., Gainesville. Center for Wetlands.
H. T. Odum.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 9-18, 1978. 5 Fig, 7 Ref.

Descriptors: *Wetlands, *Value, *Ecosystems, *Evaluation, Energy, Waste water treatment, Groundwater recharge, Flood protection, Wildlife habitats, Ecosystems, Ecology, Water resources development.

Wetlands are natural water management and treatment systems that operate on solar energy and are self-maintaining. These systems can be used as interfaces with wastes of urban landscapes. Wetlands converge products of natural work from surrounding lands and thus are more valuable than many other lands. Value can be estimated from energies flowing or embodied in structure and services times a factor by which natural resources attract matching energy accompanied by dollar flow. The web of laws preventing a symbiotic coupling of wetlands and urban growth needs to be replaced with tax incentives for private developers to retain wetlands functions of importance to the public economy. (See also W80-02253) (Howard-Mass).
W80-02256

OVERVIEW OF MAJOR DEVELOPMENT IMPACTS ON WETLANDS,
Texas A and M Univ., College Station. Dept. of Oceanography.
R. M. Darnell.
In: Proceedings of the National Wetland Protec-

tion Symposium, June 6-8, 1977, Reston, Virginia, p 19-27, 1978. 2 Tab, 1 Ref.

Descriptors: *Wetlands, *Construction, *Environmental effects, Sedimentation, Wildlife habitats, Water resources development, Preservation, Suspended load, Ecology, Ecological effects.

The primary categories of environmental impact of construction activities in wetlands, in order of importance, include habitat modification and loss, increase in suspended sediments, bottom sedimentation, and modification of water flow regime. A need exists for a solid information base, synthesized into its critical elements and key processes, to provide the basis for informed action. The link between the environmental scientist and the environmental administrator must be strengthened to achieve the best, least cost solutions to the complex wetland protection problems facing the nation. (See also 80-02253) (Howard-Mass).
W80-02257

MINIMIZATION OF CONSTRUCTION IMPACTS ON WETLANDS: DREDGE AND FILL, DAMS, DIKES, AND CHANNELIZATION,
Texas A and M Univ., College Station. Dept. of Oceanography.
R. M. Darnell.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 29-36, 1978. 1 Ref.

Descriptors: *Wetlands, *Construction, *Environmental effects, Dredging, Dams, Channeling, Land fills, Ecological effects, Water resources development.

Environmental impact may be minimized at many levels: through the establishment of national priorities; passage of appropriate legislation; adoption and implementation of managerial guidelines; evaluation of preconstruction alternatives; on-site activities and post-construction recovery; and application of judicial process in the interpretation of environmental policy. General and operational principles of impact minimization are discussed along with specific recommendations for minimizing the impact of dredging and filling, damming, diking, and channelization activities. (See also W80-02253) (Howard-Mass).
W80-02258

WETLAND CLASSIFICATION IN WESTERN CANADA: A GUIDE TO MARSHES AND SHALLOW OPEN WATER WETLANDS IN THE GRASSLANDS AND PARKLANDS OF THE PRAIRIE PROVINCES,
Canadian Wildlife Service, Saskatoon(Saskatchewan).
J. B. Millar.
Availability: Information Canada, Ottawa K1A 0S9. Report Series Number 37, 1976. 38 p, 8 Fig, 6 Tab, 46 Ref, 3 Append.

Descriptors: *Wetlands, *Canada, *Classification, Marshes, Marsh plants, Vegetation, Rooted aquatic plants, Aquatic plants, Salinity, Waterfowl, Ponds, Water regime, Water levels, Grasslands.

Wetland vegetation is divided according to species composition or zones as follows: wet meadow, shallow marsh, emergent deep marsh, transitional open water, shallow open water, open alkali and disturbed. The first five zones form a gradient indicative of depth and duration of flooding. With one exception, basic wetland types are defined and named in terms of the vegetation zone which occupies the central or lowest portion of the depression. The proportion of the wetland occupied by the central vegetation zone, the density of emergent vegetation, at its center, the extent and reason for that density value and the pattern of vegetation zones all contribute additional information about the wetland's moisture regime and relative stability. Vegetation can also be used to interpret a wetland's salinity. Three physical features--size, basin depth and position on the watershed--are included in the classification system. The various criteria are intended to be used individually or in whatever combination are best suited to a particular project. (Stihler-Mass)
W80-02321

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

SURVEY AND COMPARISON OF CALIFORNIA WATER AGENCIES-RATE STRUCTURE,
Otay Municipal Water District, Spring Valley, CA.
G. M. Reiter.
Journal of the American Water Works Association, Vol 69, No 7, p 356-363, July 1977.

Descriptors: *Water rates, *Pricing, *Water works, *Data collections, Water users, Water utilization, Water transfer, Water importing, California, Water conservation, Water demand, Utilities, Water supply, Surveys, Costs, Water distribution(applied).

An in depth survey of California water agencies pricing schedules suggests that price comparison between water utilities is virtually impossible due to the number of variables affecting each individual situation. Location of the agencies water supply, topography of the area, age of the facility, number of customers per hectare, type of consumer, size of the service area, the growth or development of the area, quality of the water supply, amount of water distributed, inflation and energy costs, fire protection facilities, and use of the general tax all enter into pricing structure decisions. A linear regression was used to determine if any correlation existed between the variables and water rates. No direct correlation was found. However, several distinct trends were noted. More agencies are beginning to abandon the traditional minimum charge with an allowable unit of water for this minimum, followed by a descending rate block. A service or capacity charge with a single commodity rate is becoming more common due to water conservation pressures. No-growth programs, charges for sewer service, and additional demand for engineering services are also more frequent considerations. (Luedtke-Wisconsin)
W80-02003

SEWAGE SLUDGE TRANSPORT COSTS,
Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.
R. L. Christensen, and G. C. Reisner.
Compost Science and Land Utilization, Vol 20, No 1, p 32-34, 1979. 5 Tab.

Descriptors: *Costs, *Sewage disposal, *Transportation, Sludge disposal, Operating costs, Capital costs, Cost analysis, Landfills, Land spreading, Methodology, Waste disposal.

A methodology for estimating costs of transporting sewage sludge to landfill or farmland spreading disposal site alternatives is described. First, ownership and operating costs per hour are determined for the transportation equipment; a dump truck and tank truck in this illustration. Depreciation, interest on investment, insurance, taxes, fuel, oil, lubrication, and repairs are taken into account. Second, sludge handling was considered. Factors include: (1) the type of transportation used, which depends on the solids content of the sludge; (2) the volume of sludge; and (3) the distance traveled. Cost per ton is calculated by determining cost per load bringing together travel time, loading and unloading time, miscellaneous time, labor costs per hour, and ownership and operating costs per hour. Finally the cost data is converted to a solids basis. Results show that transport cost per dry ton decreases as solids content increases, and transport cost increases with distance. However, the cost increase per mile must be qualified by the level of solids content. (Luedtke-Wisconsin)
W80-02007

NATURAL RESOURCE POLICY: THE DISTRIBUTIONAL IMPACT ON CONSUMERS OF CHANGING OUTPUT PRICES,
Montana State Univ., Bozeman. Dept. of Agricultural Economics and Economics.
D. J. YoungDay, and R. D. Fight.
Land Economics, Vol 55, No 1, p 11-27, February 1979. 2 Fig, 4 Tab, 18 Ref.

Descriptors: *Natural resources, *Policy, *Prices, *Income distribution, *Economic impact, Production, Economics, Consumption, Input-output analysis, Social aspects, Regulation, Taxes, Pollution taxes(Charges), Equations, Mathematical models, Forestry, Construction materials, Lumber.

This paper develops a methodology for examining impacts on consumer purchasing power of changes in output prices stemming from widely ranging natural resource policies; the methodology is applied to timber resources and concludes that increases in forest product prices have a strongly regressive impact on income distribution. The methodology develops theoretical relations between policy and output prices and considers relations between these prices and consumer welfare. Production structure is represented by an input-output model. Natural resource policies affect prices in four principal ways: prices may be regulated, such as for natural gas and oil; policies may enhance or restrict natural supply of a resource, such as designating wildlife preservation areas; environmental policies may require additional inputs in resource extraction and processing, such as land reclamation by strip miners; and taxes may be levied on resources. Higher forest product prices may result from environmental regulation; taxing methods are likely to be regressive. It is assumed that existing housing prices respond significantly to new housing costs. Subsidizing forest products production in order to promote low housing prices with the intention to benefit low income classes, would be costly because it is not well targeted to this group. Application to forest products suggests that the approach outlined can be successfully applied to evaluating distributional impacts of resource policy changes. (Danovich-Wisconsin)
W80-02012

LABOR WAGE RATES, PRODUCTIVITY, AND THE COST OF WATER SUPPLY,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. M. Clark.
American Water Works Association Journal, Vol 71, No 7, p 364-368, July 1979. 8 Fig, 4 Tab, 5 Ref.

Descriptors: *Operating costs, *Capital costs, *Water costs, *Cost analyses, *Cost comparisons, *Budgeting, *Water supply, *Annual costs, *Indirect costs, *Maintenance costs, Wages, Economics, Cost allocation, Fairfax County(VA), San Diego(CA), Labor costs, Water supply systems.

This article analyzes and summarizes the cost elements of water supply systems for two areas, Fairfax County, VA, and San Diego, CA, drawn from a larger U.S. Environmental Protection Agency study of 12 urban areas. The central thesis is that utility managers must look at elements other than capital facilities costs in attempting to minimize the overall cost of water supply. The system operating costs of both areas increased dramatically over the 1965-1974 study period, with Fairfax County increasing its OM cost as a percentage of total cost from 65 to 70%, and San Diego's increasing from 74 to 87%. Equations are presented which show that, over time, a utility's operating costs represent an increasingly larger share of its budget. Support services are the most rapidly increasing portion of operating costs, with labor cost increases being somewhat less significant. A regression equation relates cost to labor wages and indicates that annual operating cost increases almost linearly with respect to increases in revenue-producing water, if labor wage rates remain constant. Conclusions indicate that operating cost elements, particularly labor productivity, have been ignored in considering a utility's budget. Thus, utility managers are advised to think in terms of balanced capital investment designed to minimize total costs and not simply to minimize capital investment alone. (Arnold-NC)
W80-02047

WHAT COULD WATER REGULATIONS COST,
Southern Illinois Univ. at Carbondale.

E. E. Cook, L. Rogers, and J. H. Yopp.
Environmental Science and Technology, Vol 13, No 6, p 656-660, June 1979.

Descriptors: *Regulation, *Illinois, *Water quality standards, *Mercury, *Economic impact, *Toxicity, Costs, Water pollution control, Economics, Mathematical studies, Equations, Discharge(water), Effluents, Environmental effects, Industries, Waste water treatment, Benefits, Treatment facilities, Schools(Education).

Water pollution control costs are examined using Illinois mercury effluent standards as an example; increasing the mercury effluent standard from 0.5-3.0 micro g/l results in $136.3-153.8 million cost savings, 540-1890 job retention, and $5.5-29.5 million/y payroll. In November 1976, the Illinois Institute for Environmental Quality proposed the mercury effluent standard change. Since 1974, 170 dischargers violated the present 0.5 micro g/l mercury effluent standard and 33 exceeded the proposed 3.0 micro g/l standard. The adjusted mean mercury effluent concentration for five Illinois industries exceeds the present standard. Costs for all five industries are $28.9 million/y for mercury treatment. At the proposed standard, only one discharger must treat mercury at a $733,000/y cost, thus decreasing treatment costs 97.5%. At the 0.5 micro g/l standard treatment costs vary 0.04%-184% of respective industries' 1976 corporate net income. Five municipal sewage treatment plants exceed the present 0.5 micro g/l standard. Mercury treatment costs $134.6 million/y; at 3.0 micro g/l standard, treatment costs for the sole discharger would be $377,000/y, representing a 99.7% savings. Seven educational institutions violate the present mercury effluent standard. Mercury treatment costs $2.2 million/y and if the standard is relaxed to 3.0 micro g/l, two institutions would be obligated to treat mercury at a $724,000 cost, a 66-67% decrease. (Danovich-Wisconsin)
W80-02132

OPTIMAL POLLUTION IN THE PRESENCE OF ADJUSTMENT COSTS,
Newcastle upon Tyne Univ. (England). Dept. of Economics.
B. Beavis.
Journal of Environmental Economics and Management, Vol 6, No 1, p 1-10, 1979. 3 Fig, 6 Ref.

Descriptors: *Optimization, *Costs, *Adjusted costs, *Mathematical models, *Path of pollutants, Water pollution control, Equations, Time, Discharge(water), Effluents, Water pollution, Damages, Pollutants, Pollution taxes(charges), Biodegradation, Pollution abatement, Flow, Discount rates.

Industry is faced with adjustment costs when changing their pollution discharge levels from production; even if long run optimum stock of pollution is below initial levels, adjustment costs imply an optimally increasing stock of pollution in the short run. An extended Harford model takes into account persistent and degradable pollutants whose environmental effects entail stock-flow relationships. General appropriate steady-state equilibrium conditions and specific optimal time paths for relevant variables are derived. Consideration is also given to fiscal implications resulting from adjustment costs. Marginal costs of particular abatement levels depend on how rapidly levels are changing. However, a unique value for marginal abatement costs can be determined independently of abatement change rates. Both these possibilities are compared with similar models. Along optimal paths, abatement flow and stock of pollution converge asymptotically to their equilibrium levels. If ecological equilibrium doesn't initially exist, it is optimal to allow pollution to increase for sometime, even though it exceeds equilibrium levels, and resulting damages are considerable. In these situations, environmental benefits occur only after a considerable time lapse. Where damages depend on flow of abatement, adjusted costs are present, and constant marginal damages are imposed, appropriate polluting taxes are also constant and equal to the constant marginal damages level. (Danovich-Wisconsin)
W80-02133

COST OF WATER SUPPLY: SELECTED CASE STUDIES,
National Environmental Research Center, Cincinnati, OH. Water Supply Research Lab.
R. M. Clark, J. A. Machisko, and R. G. Stevie.
Journal of the Environmental Engineering Division, ASCE Vol 105, No 1, p 89-100, February 1979. 3 Fig, 8 Tab, 10 Ref, 2 Append.

Descriptors: *Water supply, *Costs, *Water costs, Potable water, Water quality, Water works, Safe Drinking Water Act, Public utilities, Utilities, Capital costs, Operating costs, Maintenance costs, Mathematical models, Equations, Depreciation, Projections, Forecasting.

Water rates during 1964-1974 from 12 water utilities across the U.S. show general increases in demand for revenue-producing water, labor wage rates, and other operating and capital expenses associated with water supply. Total production water costs will increase by 59% ($11.6-18-5 million/yr) between 1975-1980 due to normal demand and inflationary pressures. With the most expensive technology, granular activated carbon (with separate contractors), total production water costs will increase by another 22% to $22.6 million/yr. This study, prompted by the 1974 Safe Drinking Water Act, presents data from selected water utilities including at least one class A utility (revenues greater than $500,000/yr) in each of 10 EPA regions. Average total expenditures increased 108% over the 10-year period, but unit costs increased only 52%. Average revenue-producing water has continually increased, from 23 billion gallons (87 million cu m/yr) in 1964, to 32 billion gallons (120 million cu m/yr) in 1974, a 13% increase. Operating costs increased 127%; capital costs increased 78%. Energy costs went up nearly exponentially and increased faster than chemical costs. The ratio of operating costs to annual depreciation has continually increased. Mathematical models relating annual operating cost to labor wage rate, labor productivity, and revenue-producing water and relating capital cost to unit depreciation and revenue-producing water are also developed. (Danovich-Wisconsin)
W80-02134

SHOULD YOU BUY NOW. THE IMPACT OF INFLATION ON POLLUTION CONTROL EXPENDITURES,
De la Rue (Robert E.) Associates, Santa Clara, CA.
For primary bibliographic entry see Field 6B.
W80-02135

LOW COST, LABOR INTENSIVE COASTAL DEVELOPMENT APPROPRIATE TECHNOLOGY,
M. Porraz, and R. Medina.
Sea Technology, Vol 18, No 8, p 19-24, August 1977.

Descriptors: *Developing countries, *Technology, *Coastal structures, *Beach erosion, *Coastal zone management, Labor, Labor supply, Capital, Costs, Coasts, Erosion, Erosion control, Construction, Economics, Breakwaters, Mexico, Construction materials, Riprap, Roadbanks.

An alternative solution for solving river and sea erosion control problems in developing countries calls for using materials readily available in the region, low cost equipment, tools which are easy to acquire and transport and do not require costly infrastructure, and employment of local unskilled labor. Operational Designs Systems (ODS) technology was intensively researched in Mexico for more than seven years and relies on latest developments in materials technology combined with marine and hydraulic engineering concepts and procedures. Main project aims were to develop simple and practical systems. Using a small portable pump, artificial synthetic textile containers are filled with a sand-water mixture and solid but flexible 3-30 ton blocks are obtained. A more permanent solution utilizes flexible, textile impervious forms of predetermined shape which allow building big concrete blocks on the exact project site; they are used for breakwaters, jetties, revetments, and groins. Another ODS element consists of flexible, synthetic textile forms which are also filled at the site with a water-sand-cement mixture to form concrete mats. These are suited for irrigation channels, riverbanks, and road embankment revetments. Structures in Mexico, Venezuela, and Kuwait behave satisfactorily and resist extreme oceanic conditions. Required building time is also less than with more conventional methods and systems allow work interruption without increasing total investment. (Danovich-Wisconsin)
W80-02142

THE BACKWARD INCIDENCE OF POLLUTION CONTROL-SOME COMPARATIVE STATICS IN GENERAL EQUILIBRIUM,
Wesleyan Univ., Middletown, CT. Dept. of Economics.
G. W. Yohe.
Journal of Environmental Economics and Management, Vol 6, No 3, p 187-198, 1979. 2 Fig, 10 Ref.

Descriptors: *Economics, *Water pollution control, *Elasticity of demand, *Regulation, Pollution abatement, Production, Mathematical models, Mathematical studies, Equations, Effluents, Employment, Labor, Capital, Water quality standards, Equilibrium, Income.

Depending upon particular circumstances, the cost burden of increasingly stringent pollution controls may be shifted forward on customers of polluting products, or backwards to various production factors; this paper addresses impacts of more restrictive pollution control on relative income shares of production factors. Incidence direction depends upon the relative factor intensity of the nonpollution sector, and its magnitude depends upon relative price elasticities in both pollution and nonpolluting sectors. The general equilibrium model consists of a simple full-employment economy that is divided into polluting and nonpolluting sectors. If governments accompany stricter controls with public relations campaigns aimed at reducing consumption of polluting sector's products, price elasticity of demand in pollution sectors would be lowered in the long run. Polluting sector contraction would therefore be exaggerated, and the incidence, in either direction would be more severe. However, such a campaign reduces possibilities of the reversed incidence case with its incumbent difficulties in achieving lower pollution levels. Contracting the polluting sector causes some short-run unemployment which persists until long run adjustments are completed. If research programs improve pollution cleansing technology and if pollution is easier to remove from industrial effluent, smaller adjustments would be made. Similar effects are noted if training programs and production research allow capital and labor to substitute more easily for one another. (Danovich-Wisconsin)
W80-02143

A DETERMINATION OF THE OPTIMAL PRICE OF UNDEPLETABLE EXTERNALITIES,
Energy Information Administration, Washington, DC. Office of Energy Source Analysis.
N. D. Uri.
Journal of Environmental Management, Vol 8, No 2, p 95-104, March 1979, 7 Ref.

Descriptors: *Economics, *Optimization, *Competition, *Equilibrium prices, *Pricing, *Externalities, Equations, *Water pollution control, Air pollution, Taxes, Environmental control, Mathematical studies, Social aspects, Welfare(Economics), Clean Air Act, Pollution abatement.

A satisficing approach is used to determine the fee for achieving a given level of undepletable externality. Policy implications from similar studies show that to meet a given ambient standard at minimum costs, different emission fees should be imposed on each firm. A competitive Negishi-type model is used in this investigation. Competitive equilibrium is the maximum point of a social welfare function. With a satisficing approach, the most efficient method of obtaining an ex-ante selected emission level is sought, and, consequently, the resulting solution is second best. To find a quasi-optimal

pareto solution, social welfare is maximized, subject to requirements that no consequent loss occurs to any other individual and that constraints constituted by production functions and resource availability are satisfied. The solution gives two results. If an iterative emission fee achieves emission standards, the solution is quasi-optimal Pareto, in the sense that customers have maximized their utility for given emission levels. Appropriate emission fees equal either of two equations given in the paper. As a practical matter, quasi-optimal fees are not compatible with current water pollution legislation but are compatible with the Clean Air Act. For air pollution control, implementation is both administratively and legally defensible. (Danovich-Wisconsin)
W80-02144

LAND TREATMENT VS. AWT--HOW DO COSTS COMPARE,
Metcalf and Eddy, Sacramento, CA.
R. W. Crites, M. J. Dean, and H. L. Selznick.
Water and Wastes Engineering, Vol 16, No 9, p 51-53, September 1979. 4 Fig.

Descriptors: *Costs, *Waste water treatment, *Land, *Tertiary treatment, Curves, Waste treatment, Flow, Economics, Land use, Land appraisals, Sewage, Capital costs, Operating costs, Maintenance costs, Economic efficiency, Sewerage, Warren(MI), Muskegon(MI).

Land treatment systems are less expensive than advanced wastewater treatment (AWT) systems for 0.5-50 mgd flow ranges when new treatment facilities must be built, based on $4,000/acre laand prices. However, land treatment remains more capital-intensive and land cost is still a significant percentage of capital and total costs. Some cost components are site-specific. Curves are based on typical unit costs and assumptions; they do not account for local variations such as land prices, type of pre-application treatment, energy prices, storage times and force main distance. Land prices account for as much as 57% (for slow rate systems) of land treatment total costs whereas for AWT, land is seldom more than 1% total cost. Land treatment and AWT systems are compared in two, similar-sized, Michigan cities. The Muskegon system is a slow rate system (sprinkler irrigation) while Warren has a nitrification (but not denitrification) and phosphorus removal plant. In Muskegon, most flow is industrialwhile in Warren, most flow is domestic. Average flows and design capacities are similar. The Muskegon facility has slightly lower overall gross costs, but is more capital-intensive than the Warren facility. Capital investments are actually about the same, but O&M costs at Warren (24.6 cents/1,000 gal) are much higher than at Muskegon (7.1 cents/1,000 gal). (Danovich-Wisconsin)
W80-02145

STREAM CHANNELIZATION (P.L. 83-566) INCREASED WETLAND LOSSES IN THE DAKOTAS,
Fish and Wildlife Service, Bismark, ND.
For primary bibliographic entry see Field 6E.
W80-02300

FUTURE SOURCES OF COOLING WATER FOR POWER PLANTS IN ARID REGIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 3E.
W80-02354

6D. Water Demand

CHANGING PATTERNS OF OUTDOOR RECREATION PARTICIPATION IN NORTHEASTERN UNITED STATES,
Vermont Univ., Burlington.
M. I. Bevins, T. L. Brown, G. L. Cole, K. J. Hock, and M. W. Kottke.
Delaware Agricultural Experimental Station Bulletin, No 427, April 1979, 80 p, 7 Fig, 29 Tab, 10 Ref, 4 Append.

Descriptors: *Recreation demand, *Market research, *Surveys, *Northeast US, *Use rates, *Social participation, *Data collections, Recreation, Travel, Jogging, Canoeing, Snowmobiling, Camping, Tennis, Bicycling, Picnicking, Ice skating, Fishing, Sailing, Boating, Hiking, Hunting, Swimming, Motorcycling, Backpacking, Golf.

The extent to which substitutions and other changes in outdoor recreation are taking place and how they relate to changing socioeconomic conditions were studied as part of an outdoor recreation market research program in the northeastern states. Significant changes occurring in 22 outdoor recreation participation patterns were surveyed with a telephone interview of 3900 adults in a 13-state area in 1977. Eighty-five percent of those surveyed participated in at least one of the 22 activities; 42% adopted new activities with 44% increasing and 64% decreasing participation in at least one activity and 61% of these indicating a variation in place of participation, all in a two-year period. Cross-Country skiing, jogging, canoeing, snowmobiling, recreation vehicle camping and tennis were high growth activities. Bicycling, picnicking, and ice skating were the only activities not having increased demand. Sailing, motor boating, backpacking, tenting, freshwater and saltwater fishing, golfing, hiking, hunting, motorcycling, downhill skiing, water skiing, and swimming were the other activities considered. Net gain in travel occurred for 17 of the 22 activities and was substantial for such 'energy efficient' activities as backpacking, tenting, and hiking. The need for better trend indicators and monitors of chaning markets is recommended to permit more efficient planning of public and private investments in recreation land use. (Luedtke-Wisconsin)
W80-02008

AN ANALYSIS OF RESIDENTIAL DEMAND FOR WATER USING MICRO TIME-SERIES DATA,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
L. E. Danielson.
Water Resources Research, Vol 15, No 4, p 763-767, August 1979. 3 Tab, 24 Ref.

Descriptors: *Water demand, *Prices, *Time series analysis, *Domestic water, *Raleigh(NC), *North Carolina, Consumptive use, Potable water, Economics, Economic impact, Seasonal, Temperature, Rainfall, Equations, Sprinkler irrigation, Surveys, Lawns, Meter readings, Elasticity of demand.

Water demand analysis using monthly cross-section and time series meter readings from 261 residential households in Raleigh, North Carolina, May 1969-December 1974 generally shows that sprinkling demand is highly responsive to water price, while in-house or winter demand is less responsive. Variables used in calculating residential demand include rainfall, average temperature, water price, house value, lot size, and household size. Water price rose during the sampling period from $0.7019 to $1.1611 per 1000 gallons, first block price. Average daily water consumption is 205.9 gal/household/day. Average household size is 3.07 persons and average appraised house value is $18,376. Price elasticity is -0.27. Household size consistently explains water demand more than any other variable; an increase in household size from three to four (33%) increases water use 24% or over 50 gal/household/day. Sprinkling demand for each customer is estimated by subtracting winter (November-April) use from summer (May-October) use, assumig that winter use equals summer in-house use. Water sprinkling use averages 27 gal/household/day. Sprinkling water price elasticity is -1.38, considerably more elastic than winter or total residential demand. A 10% price increase is associated with a 13.8% decreases in sprinkling demand, or 3.75 gal/household/day. (Danovich-Wisconsin)
W80-02009

SAFE DRINKING WATER: CURRENT AND FUTURE PROBLEMS - PROCEEDINGS OF A NATIONAL CONFERENCE IN WASHINGTON, D.C.
Reseach Paper R-12. Resource for the Future, Washington, DC, 1978. Russell, C. S., editor. 641 p.

Descriptors: *Water quality, *Water quality control, *Potable water, *Drinking water, *Safe Drinking Water Act, *Water quality standards, *Legislation, Governments, Water pollution, Epidemiology, Financing, Water purification, Wastewater, Environmental sanitation, Pollutants, Water treatment facilities, Water utilization, Public health, Carcinogenic effects, Toxins, Health effects, Municipal systems.

This is a collection of papers presented at proceedings concerned with the U.S. Environmental Projection Agency's (EPA) setting of standards called for in the Federal 1974 Safe Drinking Water Act. The technical background concerning safe drinking water is presented, with discussions of the European and British experiences; costs and financing of compliance with the Act are discussed; and specific problems are identified and discussed. Problems lie with the capability of local governments to set proper safe drinking water standards and develop a rationale that follows a uniform and consistent approach to standard setting. The absence of such a rationale is asserted to have produced economic and health inequalities for the public. Data indicate that known carcinogens such as vinyl chloride and suspected carcinogens such as benzene, dieldrin, PCB, kepone, and aldrin have been carefully measured in sampled water, and drinking standards must address these substances thoroughly. Recommended are that federal and state governments remove impediments to local financing of better engineered drinking water systems. More data are also needed on the costs/benefits of home filters. Local governments may have difficulty meeting the new Safe Water Drinking Standards without adequate federal/state funding. Proposed policy options recommended for local government compliance with the Act include changing the locality's raw water source, installation of a dual-or triple-distribution system, furnishing bottled water to some areas, and the EPA proposal to use granular activated carbon for controlling synthetic organics in the water supply. (Arnold-NC)
W80-02027

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX XVII-NAVIGATION.
California Region Framework Study Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 171, Price codes: A12 in paper copy, A01 in microfiche. Prepared for Pacific Southwest Inter-Agency Committee, Water Resources Council, June 1971. 267 p, 42 Tab, 11 Maps, 1 Drawing, 3 Supplements, 53 Ref.

Descriptors: *Water resources development, *California, *Navigation, *Harbors, *Multiple purpose projects, *Navigable waters, *Water resource planning, *Oregon, Planning, Recreation, Boating, Costs.

This appendix is part of a larger study undertaken to evaluate alternative water and related land resources for the California Region, an area consisting of California and 7% of Oregon. This appendix presents an evaluation of the future needs for commercial and recreational navigation facilities in the Region. A regional summary of existing and future needs is followed by a summary of data from each of the region's 11 subregions. Commercial navigation centers around the major coastal harbors, particularly those of Los Angeles and San Francisco, as does the recreational fleet of individual pleasure craft. Steady increases in the use of navigation and in commercial and pleasure craft are predicted between 1965 and 2020, with a 200% increase in petroleum product shipment projected for this period. Costs of installing proposed commercial and recreational navigation facilities during the study period (1965-2020) would be about $1,543 million and $797 million, respectively, including harbors of refuge for the latter. Recommendations include the incorporation into a master plan of navigation elements set forth in the report, includ-

ing channel widening/dredging; cargo handling area enlargement; construction of a chain of refuge harbors for small craft; more extensive data collection for subregional needs; and an investigation into alternatives to major channel/harbor deepening for petroleum tanker accomodation. (Arnold-NC)
W80-02036

TREATMENT TECHNOLOGY TO MEET THE INTERIM PRIMARY DRINKING WATER REGULATIONS FOR ORGANICS: PART 4,
Environmental Monitoring and Support Lab., Cincinnati, OH. Physical and Chemical Methods Branch.
For primary bibliographic entry see Field 5G.
W80-02043

DEVELOPING A CONSERVATION PROGRAM TAILORED TO AREA NEEDS,
Mathematical Sciences Northwest, Bellevue, WA.
For primary bibliographic entry see Field 3D.
W80-02045

URBAN DROUGHT IN THE SAN FRANCISCO BAY AREA: A STUDY OF INSTITUTIONAL AND SOCIAL RESILIENCY,
Teknekron, Inc., Berkeley, CA.
M. Hoffman, R. Glickstein, and S. Liroff.
American Water Works Association Journal, Vol 71, No 7, p 356-363, July 1979. 7 Fig, 2 Tab.

Descriptors: *Water supply, *Water resources planning, *Water costs, *Water conservation, *Water policy, *Water use, *Droughts, *Water demand, Water consumption, San Francisco(CA), California, Social aspects, Institutions, Governments, Water rationing, Water yield, Water supply development.

The authors analyze the political and policy making climate surrounding decisions about how to deal with the 1976 and 1977 droughts in the San Francisco Bay Area. The study focussed on 8 agencies supplying water to more than 3 million people. Major area water supplies differed greatly in their vulnerability to the drought. Droughts can usually be predicted with some accuracy by mid-February of the December-March rainy season in this area, leaving only a short span of 6-8 weeks in which to make decisions about the whole year's precipitation. In addition, staff philosophy that drought years do not occur back to back contributed to water utility failure to plan adequately for drought conditions. Factors influencing successful drought planning included the early institution of a water rationing plan and development of policies to augment area water supply. Marin County had to cut its consumption by as much as 57% due to its policies, yet a Santa Clara County utility had adequate groundwater supplies and adequate planning so that no cutback to customers during the droughts was required. The major outcome of the droughts is to cause localities to abandon traditional water planning and to incorporate structural and behavioral conservation modes in customer water use. (Arnold-NC)
W80-02046

LABOR WAGE RATES, PRODUCTIVITY, AND THE COST OF WATER SUPPLY,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 6C.
W80-02047

ASSESSING PUBLIC GROUND-WATER SUPPLIES IN ILLINOIS,
Illinois State Water Survey, Urbana. Hydrology Section.
For primary bibliographic entry see Field 2F.
W80-02170

GROUND-WATER RESOURCE MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Inst. of Agriculture and Natural Resources.
For primary bibliographic entry see Field 4B.
W80-02171

FUTURE SOURCES OF COOLING WATER FOR POWER PLANTS IN ARID REGIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 3E.
W80-02354

6E. Water Law and Institutions

THE NEW LAW OF THE SEA OPPORTUNITIES FOR OCEAN INDUSTRIES,
University of Wales Inst. of Science and Technology, Cardiff.
A. V. Lowe.
Ocean Management, Vol 4, p 151-161, 1978.

Descriptors: *UNCLOS III, *Informal composit negotiating text, *Ocean industries, *International law, *International waters, Political aspects, Economics, Investment, Fisheries, Energy, Legal aspects, Water policy, Oil, Governments, Oceans, Mining, Exclusive economic zone, Offshore platforms, Planning, Marine resources, Continental shelf, Industries.

Implications of the Informal Composite Negotiating Text of the Third United Nations Conference on the Law of the Sea (UNCLOS III) for ocean resource development are outlined. Two new factors are overturning the former laissez-faire approach to ocean resources: (1) emergence of the 200 mile Exclusive Economic Zone which gives countries exclusive rights over the sea's resources will probably bring more than one third of the high seas under the control of coastal nations, and (2) UNCLOS III is attempting to establish an international authority to govern development of the deep sea bed which lies beyond the continental boundaries of coastal States. This would establish a clear legal jurisdiction for these areas, which could give commercial operators secure legal rights against third parties and encouraging investment. It also could equally restrict operations in these areas. Fisheries, fish farming, petroleum, wave power and other installations, pollution, conflicts of use, disputes, deep sea bed exploitation, scientific research and transfer of technology are discussed in the context of these implications. Other considerations of importance to the ocean industries are preferential rights given to developing Third World States, the political stability of the host state to protect investments, and time factors involved in putting UNCLOS III into force. (Luedtke-Wisconsin)
W80-02005

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: MAIN REPORT.
California Region Framework Study Committee.
For primary bibliographic entry see Field 6B.
W80-02033

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX XVI-SHORELINE PROTECTION AND DEVELOPMENT.
California Region Framework Study Committee.
For primary bibliographic entry see Field 6B.
W80-02035

THE DARK AND BLOODY GROUND OF INDIAN WATER RIGHTS: CONFUSION ELEVATED TO PRINCIPLE,
California Univ., Los Angeles. Dept. of History.
N. Hundley, Jr.
The Western Historical Quarterly, Vol 9, No 4, p 455-482, October 1978. (California Water Resources Center Project UCAL-WRC-W-516). OWRT-A-059-CAL(2).

Descriptors: *Water rights, *Indian reservations, Legal aspects, Prior appropriation, Prescriptive rights, Water law, Federal-State Water Rights Conflicts, Irrigation, Irrigated land, Equitable apportionment, Water allocation(Policy).

What is an adequate supply of water, and how does the Indian justify his right to it. The purpose of this essay is to provide a measure of historical perspective for this question and the current disputes over Indian water rights, disputes in which the opponents invariably invoke history (or what they claim to be history) in their battles with one another. The focus is on the major developments in what has come to be euphemistically known as Indian water law and on what appear to be the principal reasons for the patterns that have emerged. (Snyder-California)
W80-02077

WHAT COULD WATER REGULATIONS COST,
Southern Illinois Univ. at Carbondale.
For primary bibliographic entry see Field 6C.
W80-02132

MANAGEMENT OF RECREATIONAL FISHERIES IN NORTHERN QUEBEC: POLICIES VERSUS TOOLS,
Brock Univ., St. Catharines (Ontario). Inst. of Urban and Environmental Studies.
F. Berkes
Canadian Public Policy, Vol 4, No 4, p 460-473, 1978. 3 Tab, 20 Ref.

Descriptors: *Quebec, Canada, *Sport fishing, *Water policy, *Fish management, *Regulation, *Fisheries, Recreation, Management, Exploitation, Indian reservations, Freshwater fish, Salmonids, Cold-water fishing, Public lands, Reasonable use, James Bay, Canada, Fish populations, Social participation, Social aspects, Social impact, Conservation.

Implicit policy assumptions, as revealed by management tools, are explored with respect to recreational fishery management in northern Quebec, Canada. Sport fishing in this area has been almost eliminated since 1972, pending court case and negotiations which led to the James Bay and Northern Quebec Agreement between governments (federal and provincial), native parties (Cree Indians and Inuit) and development corporations. The agreement was signed in 1975 but recreational fishing is delayed until 1984 and construction completion of La Grand Hydro Complex. Alternative fishery management strategies are liberal or large yields and conservative or multiple-use. The large-yield strategy works only as long as fishing pressure is low in comparison to biological potential. Large yield strategies have resulted in mismanaged fisheries and it is unrealistic to expect that stocks are conserved by gradually tightening regulations as fishing activity increases; it is necessary to establish preventive measures. The conservation and multiple-sue strategy implies management for relatively low but sustained-yield, long-term productivity and a quality environment. Native people gain most from the conservation strategy, since recreational fishery social impacts are minimized with relatively slow and controlled growth. Management tools include daily bag limits, closed fishing seasons, fish sanctuaries, closed to the fishing year-round, regulation enforcement, catch monitoring and scientific research on fisheries, and total catch control by quotas. (Danovich-Wisconsin)
W80-02138

COMMITMENTS, PRIORITIES, AND ORGANIZATION OPTIONS FOR WATER RESOURCE PLANNING IN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Political Science.
J. W. Westphal, and J. J. Lawler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-122799, Price codes: A16 in paper copy, A01 Microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Technical Completion Report, August 1979. 346 p 15 Fig, 32 Tab, 5 Append. OWRT A-076-OKLA(1). 14-34-0001-8038.

Descriptors: *Institutional constraints, *Inter-basin transfers, *Interconnected systems, *Water resources development, *Water allocation, *Water resources planning, Legal aspects, Institutions, Ad-

ministration, Water law, Water management, Water policy, Political constraints, Water rights.

Interbasin water transfer from eastern to central and western Oklahoma was analyzed from he standpoint of present commitments and priorities of existing water supplies, available options for water development, and processes of water resource planning. Research method included interviews, a statewide mailbag elite-option survey, legal research, and analysis of legislative bills and other documents. Legal constraints discussed included: Oklahoma's dual water rights system in which prior appropriation governs streamwater and surface ownership determines groundwater rights, statutory protection of the area of origin, federal and state environmental legislation, and Indian claims to waters designated for transfer. Institutional constraints include historic identification of the Oklahoma Water Resources Board with the controversial transfer plan, interagency rivalry for jurisdiction over aspects of water resources, and area of origin controlling more seats in the Oklahoma House of Representatives than the other regions. Survey findings and legislative analysis indicate a tripartite regional division, in which the intermediate position of Central Oklahoma on the issue has been decisive in coalitions. Given these constraints, the following alternatives for water development policy were evaluated: definitions of 'surplus water' based on prior rights or future needs, and of 'area of origin' on a hydrologic or governmental basis, appropriate safeguards for the area of origin and for 'instream' values, various proposals for reorganizing adjudicative, planning and financing functions relating to water, the potential for using non-structural modes of water development, and procedures for quantitative evaluation of economic impacts.
W80-02194

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
United States Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Washington, D.C., FWS/OBS-78/97, November, 1978, 255 p.

Descriptors: *Wetlands, *Preservation, *Water resources development, Values, Hazards, Environmental effects, Federal government, Federal project policies, State governments, Local governments, Legislation, Jurisdiction, Legal aspects, Political aspects, Regulation, Mapping, Rehabilitation, Research and development, Land use, Management, Ecology, Freshwater marshes, Tidal marshes, Salt marshes, Marshes, Estuaries, Swamps.

An overall view is presented of the status of the wetland protection effort in the United States. Sections deal with wetland values and hazards, the impact of development, specific State programs, Federal agency roles, case studies of wetland uses and misuses, legal issues, wetland mapping, wetland rehabilitation, the role of the private sector and the public, and research priorities. A summary outlines future directions for the wetland protection movement. (See W80-02254 thur W80-02294) (Howard-Mass).
W80-02253

THE HAZARDS OF WETLANDS USE,
Colorado Univ., Boulder. Inst. of Behavioral Science.
G. F. White.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 3-5, 1978. 3 Ref.

Descriptors: *Wetlands, *Hazards, *Land use, *Preservation, Federal government, Insurance, Flood damage, Land development, Environmental effects, Damages, Water resources development, Erosion control.

Wetlands are subject to coastal or riverine flooding, beach erosion, and to the effects of excessive or deficient periods of precipitation. Many are vulnerable to earthquakes, landslides, or subsidence and a few are threatened by avalanches, tsunami, or volcanoes. Efforts to reduce the social impacts of extreme events under national policies for flood control, drainage, and beach erosion control may have a profound and unanticipated effect upon the future quality of the wetlands. Those efforts which do not adequately allow for the infrequent occurrence may turn out to be counterproductive. The practical measure most likely to advance wetlands protection in the near future is strengthening of the provisions of the Federal Flood Insurance Program for State support of community planning in hazardous areas. (See also W80-02253) (Howard-Mass).
W80-02254

WETLAND VALUES,
Connecticut Coll., New London.
For primary bibliographic entry see Field 6B.
W80-02255

VALUE OF WETLANDS AS DOMESTIC ECOSYSTEMS,
Florida Univ., Gainesville. Center for Wetlands.
For primary bibliographic entry see Field 6B.
W80-02256

OVERVIEW OF MAJOR DEVELOPMENT IMPACTS ON WETLANDS,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 6B.
W80-02257

ONE WAY A WETLANDS BILL MAY BECOME LAW,
New Hampshire House of Representatives, Concord.
M. Taylor.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 45-46, 1978.

Descriptors: *Wetlands, *Legislation, *Governments, *Water resources development, Administrative agencies, Legal aspects.

Numerous pressure points are discussed where public decisions on wetland proposals may be influenced by the public during the process of changing an idea into a bill and the bill into law. Once a wetlands act becomes law, new agency regulations may have to be promuglated, appropriations secured, and personnel shifts made. The proponents and legislative sponsors should sit down and work with the administrative agency to make sure they have a 'feel' for what is intended. (See also W80-02253) (Howard-Mass)
W80-02260

STATE OF GEORGIA: WETLANDS POLICIES AND PERSPECTIVES,
Georgia Dept. of Natural Resources, Brunswick.
F. C. Marland, and J. R. Bozeman.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 47-52, 1978. 1 Tab, 20 Ref.

Descriptors: *Wetlands, *Legislation, *Georgia, Federal government, Environmental effects, Dredging, Spoil banks, Water resources development, Marshes, Freshwater marshes, Salt marshes, Administrative agencies, Tidal marshes, State governments.

The greater impacts to Georgia's wetlands at present are from Federally assisted programs in the areas of agriculture, transportation, and navigation. A holistic approach to the management and utilization of wetlands,by the agencies involved is urged. Recommendations for the Corps' navigation projects in Georgia include elimination of overboard spoiling on productive bay bottoms and sounds and reductions in dredging operations. It is recommended that Phase III of Section 404 of the Federal Water Pollution Control Act be delayed, and that extensive consultation between all levels of government be carried out along with public hearings. Each region of the country, with its varied agriculture and forestry practices, can best determine a workable 404 program. (See also W80-02253) (Howard-Mass)
W80-02261

IMPLEMENTATION OF THE VIRGINIA WETLANDS ACT OF 1972,
Virginia Inst. of Marine Science, Gloucester Point.
G. M. Dawes.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston , Virginia, p 53-56, 1978. 8 Ref.

Descriptors: *Wetlands, *Legislation, *Virginia, *Preservation, Salt marshes, Water resources development, Local government, Administrative agencies, State government, Regulation.

In the five years of implementation of the Virginia Wetlands Act, 26 out of about 40 counties and cities containing wetlands have established local wetland boards and are managing their own wetlands under the general supervision of the Virginia Marine Resources Commission. About 85 percent of Virginia's tidal wetlands are now under local control. Training of a considerable body of laymen has been accomplished. The annual rate of tidal wetland loss has decreased from 400 to 600 acres to 20 acres or less. The number of wetland applications, both numerically and as a percentage of all shoreline applications, has dropped while preapplication advisory actions of the Virginia Institute of Marine Science and the local boards has increased. An area of concern lies in the cumulative effect of many small projects and the fact that no comprehensive regulatory plan exists for inland non-tidal wetlands. Agencies must better coordinate and administer wetland laws to avoid future efforts to weaken their provisions. (See also W80-02253) (Howard-Mass)
W80-02262

MARYLAND'S WETLAND PROGRAM: A MANAGERIAL VIEW--FROM THE INSIDE,
Maryland Water Resources Administration, Annapolis.
H. M. Cassell.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 57-61, 1978. 2 Tab.

Descriptors: *Wetlands, *Regulations, *Maryland, *Legislation, Environmental effects, Political aspects, Economics, Data collection, Water resources development, State governments.

The record and costs of the Maryland Wetland Program of 1970 are examined along with the existing data utilized by wetland managers in the state. The most pressing administrative need is for an organizational framework that will provide for the orderly acquisition of data. Some of the present data needs are related to: the decline of submerged aquatic plants; impacts of overboard disposal; location to acceptable spoil disposal sites; the ranges of exotic, threatened, or endangered species; and impacts of repeated burning of wetlands on nutrient and detritus releases. Public and private wetland acquisition programs in the State are discussed. (See also W80-02253) (Howard-Mass)
W80-02263

WETLAND PROTECTION EFFORTS, NEEDS, AND PRIORITIES IN WISCONSIN,
Wisconsin Univ., Madison. Inst. for Environmental Studies.
B. Bedford.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 63-68, 1978. 7 ref.

Descriptors: *Wetlands, *Legislation, *Preservation, *Wisconsin, Freshwater marshes, Water resources development, State government, Values, Administrative agencies.

The Wisconsin Conservation Department (Department of National Resources since 1967) has actively pursued a wetlands acquisiton program since

1930 in the name of hunting and fishing. Wetland protection in the State has resulted from the relationship of wetlands to navigable bodies of water, a relationship which brings some wetlands within the domain of the Public Trust and Shoreline Zoning Program. Despite a strong legal base, enforcement is eask and violations are numerous. Attempts have been made in the State legislature to weaken the definition of navigability. Many of Wisconsin's wetlands are not connected, or are connected by groundwater only, with navigable bodies of water. To date, attempts to adopt a specific wetland protection statute have been unsuccessful. Qualified field personnel, money for people to do the work, an accurate inventory, cooperation between agencies, public education, and a way to deal with the schism between agricultural and wetland values are all needed in order to bring about effective wetland protection in Wisconsin. (See also W80-02253) (Howard-Mass)
W80-02264

PROTECTION OF MASSACHUSETTS WETLANDS BY ORDERS OF CONDITIONS ISSUED BY LOCAL CONSERVATION COMMISSIONS,
Tufts Univ., Medford, MA. Dept. of Biology.
N. H. Nickerson.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 69-76, 1978. 7 Ref, 3 Append.

Descriptors: *Wetlands, *Legislation, *Massachusetts, *Preservation, Marshes, Freshwater marshes, Salt marshes, Local governments, Administrative agencies, Jurisdiction, Water resources development, State government, Permits.

The historical aspects of wetlands protection in Massachusetts are reviewed, and a discussion is provided of the mechanics and of the advantages and disadvantages of the State's local restriction approach to wetland protection. This approach could be adopted on a wider national scope. Local citizen commissions would need competent education on whatever wetland law is adopted, on conducting hearings, and on permitting and appeals proceedings. The Commissions should have technical expertise available, a facet which could be accomlished through the Soil conservation Service or Conservation Districts already present. Care should be taken that these broadly based groups do not have primary jurisdiction for wetland protection as they suffer from intensivitity to local situations and an inability to police their restrictions, (See also W80-02253) (Howard-Mass)
W80-02265

MASSACHUSETTS WETLAND RESTRICTION PROGRAM,
Massachusetts Dept. of Environmental Management, Boston.
M. Hardin.
In: Proceedings of the National Wetland protection Symposium, June 6-8, 1977, Reston, Virginia, p 77-84, 1978. 4 Append.

Descriptors: *Wetlands, *Massachusetts, *Preservation, *Legislation, Marshes, Freshwater marshes, Salt marshes, Tidal marshes, Local governments, Water resources development, Jurisdiction, State governments, Permits.

Administration of Massachusetts' Coastal Act is relatively simple. The wetlands are mapped and very little use is allowed that would interfere with the flow of water, the movement of sediments, or that would destroy vegetation. Inland wetlands do not fall neatly into categories, and problems arise in implementing the Inland Wetland Act's proposed policy of restricting use only on critical wetlands. An array of questions is listed which would help determine if a wetland may be termed 'critical.' Under the restriction program, appeals are few and violations fewer. For areas that should remain inviolate, restrictions make more sense than simple permit procedures. The major problems with the program arise from the tedious recording process and the lengthy process of working with individual landowners and town boards. (See also W80-02253) (Howard-Mass)
W80-02266

POLITICAL PROBLEMS ASSOCIATED WITH THE PASSAGE OF MEANINGFUL WETLANDS LEGISLATION: THE NEW HAMPSHIRE EXPERIENCE,
New Hampshire House of Representtives, Concord.
M. Taylor.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 85-86, 1978.

Descriptors: *Wetlands, *Preservation, *New Hampshire, *Legislation, Jurisdiction, State governments, Local governments, Water resources development.

Since 1973, there has been an effort in New Hampshire to bring the evenhandedness of state enforcement together with local concern and scrutiny in the state's wetland policy. New Hampshire has a far-reaching wetland act which extends to all surface waters of the state and the adjacent land, but a problem arises in the area of commitment to adequate enforcement. It has been determined that the State, not the municipalities, has final jurisdiction over wetlands. Some proposed changes in the law are outlined. (See also W80-02253) (Howard-Mss)
W80-02267

CRITICAL WETLANDS ACQUISITION: WISCONSIN SCIENTIFIC AREAS,
Wisconsin Dept. of Natural Resources, Madison.
C. Germain.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 87-94, 1978. 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Wetlands, *Preservation, *Wisconsin, *Legislation, Land management, Land use, Bogs, Grasslands, Swamps, Ecology, Ecological distribution, Ecosystems.

An estimated 2.5 million acres remain of the original 9 million acres of wetland soil in Wisconsin. Of the 2.5 million acres, about 1 million are already secure in some form of public conservation ownership. Most of the ownership occurs in the northern forests where losses have been negligible compared to the southeastern portion of the State. Compared to other natural lands in southern Wisconsin, wetlands, especially the more permanent types, have resisted change and now remain as essentially the only stable, natural communities and refuges for endangered plants and animals in the developed counties. Fee acquisition remains the best means of long-term preservation in Wisconsin. Scientific areas, 50% of which are wetland types, represent presettlement vegetation types in locations where they naturally occur and are a small but high impact segment of the state's conservation lands. The scientific area system alone will preserve only a few good representative examples of each of the 70 to 80 natural area types recognized, including the highest quality bogs, wet prairies, sedge meadows, river bottom forests, and conifer swamps. The large regions of parks, wildlife areas, forests, and other protected areas will help preserve natural diversity in the State. (See also W80-02253) (Howard-Mass)
W80-02268

AN OVERVIEW OF WETLAND PROTECTION EFFORTS IN NEW YORK STATE,
New York State Dept. of Environmental Conservation, Albany.
B. Haines.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 95-97, 1978.

Descriptors: *Wetlands, *Legislation, *Preservation, *New York State, Tidal marshes, Marshes, Swamps, Bogs, Local governments, State governments, Jurisdiction, Water resources development, Administrative agencies, Permits.

The several significant differences between the two regulatory permit programs in the State of New York dealing with the protection of wetland resources, the Tidal Wetlands program and the Freshwater Wetlands program, are discussed in terms of their scope and areas subject to regulation. The most critical problem encountered in the implementation of both wetland laws is lack of money. The size of the State and the number of wetlands involved become problems in the implementation of the Freshwater Wetlands Act. County councils and municipal commissions concerned with the inventory, protection and preservation of many elements of the natural environment act as important sources of information for the Department and provide education and assistance to local governments and the public. The two wetland programs added to the older Protection of Waters program provide one of the most comprehensive water resource protection efforts in the Nation. (See also W80-02253) (Howard-Mass)
W80-02269

THE FEDERAL ROLE IN WETLAND PROTECTION: AN OVERVIEW,
Environmental Defense Fund, Washington, DC.
M. J. Bean.
In: Proceedings of the National Wetland Protection symposium, June 6-8, 1977, Reston, Virginia, p 103-107, 1978.

Descriptors: *Federal government, *Legislation, *Wetlands, *Preservation, Regulation, State governments, Local governments, Administrative agencies, Water resources development, Programs, Federal project policies.

Several important Federal programs affecting wetlands are discussed to illustrate the various roles the Federal Government has historically played in wetland matters. This role will doubtlessly remain multi-faceted in the future, but growing recognition of the diverse values served by wetlands indicates that some movement toward a better coordination of the many Federal progams affecting wetlands can be expected. After the Federal programs are successfully integrated with each other, the more challenging task of coordinating them with state and local programs remains. (See also W80-02253) (Howard-Mass)
W80-02270

WETLAND PROTECTION PROGRAMS OF THE U.S. FISH AND WILDLIFE SERVICE,
Fish and Wildlife Service, Washington, DC. Office of Biological Services.
A. Hirsch.
In: Proceedings of the National Wetland protection Symposium, June 6-8, 1977, Reston, Virginia, p 109-115, 1978.

Descriptors: *Federal government, *Wetlands, *Preservation, *Legislation, Programs, Wildlife, Waterfowl, Regulation, water resources development, Research and development, Federal project policies.

The United States Fish and Wildlife Service's role in wetland protection involves three main lines of activity: wetland acquisition; participation in the environmental planning and regulatory process; and conduct of research, studies, and inventories. Original involvement stemed from the agency's responsibility for protection and management of migratory birds, particularly waterfowl. As public environmental awareness and the service's responsibilities have broadened, its programs have reflected concern for the wide range of values involved in wetlands preservation. (See also W80-02253) (Howard-Mass)
W80-02271

SCS AND THE CONSERVATION OF WETLANDS,
Soil Conservation Services, Washington, DC.
R. M. Davis.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 117-118, 1978.

Descriptors: *Wetlands, *Preservation, *Programs, Federal government, Land use, Water resources

development, Soil conservation, State governments, Local governments, Administrative agencies, Conservation, Values.

The Soil Conservation Service offers technical assistance, mainly through 3,000 local conservation districts, in many aspects of resource conservation to individuals, organization, local and state agencies, and other Federal agencies. SCS participation in activities that alter wetlands is limited by technical constraints, mainly soil potential, and by policy constraints. The agency's main goals in wetland protection are to help maintain and manage existing wetlands to help retain or increase their value, and to help balance their value with that of land for food and fiber production. (See also W80-02253) (Howard-Mass)
W80-02272

THE POTENTIAL FOR MANAGING AND PROTECTING COASTAL WETLANDS THROUGH APPROVED COASTAL MANAGEMENT PROGRAMS,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
R. W. Knecht.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 119-122, 1978.

Descriptors: *Coastal marshes, *Management, *Legislation, *Jurisdiction, Federal government, State governments, Administrative agencies, Wetlands, Preservation, Water resources development, Federal project policies.

In passing the Coastal Zone Management Act (CZMA), Congress declared the need to develop a national program for the responsible management, beneficial use, protection, and development of coastal resources. Congress made a decision to focus coastal planning and management at the state level of government and, therefore, created a program to encourage coastal states to take a lead role by exercising their full authority over coastal resources in cooperation with Federal and local governments and other concerned interests. Present efforts under the CZMA are described as well as the possibilities the Coastal Zone Management Program holds for the future in terms of assisting in the management and protection of coastal wetlands. (See also W80-02253) (Howard-Mass)
W80-02273

CORPS OF ENGINEERS EFFORTS RELATED TO WETLAND PROTECTION,
Office of the chief of Engineers (Army), Washington, DC.
J. R. Hill, Jr.
In: proceedings of the National Wetland protection Symposium, June 6-8, 1977, Reston, Virginia, p 127-132, 1978.

Descriptors: *Wetlands, *Preservation, *Federal government, *Programs, Dredging, Landfills, Values, Water resources development, Administrative agencies, Permits, Regulation, Federal project policies.

The U.S. Army Corps of Engineers' authority to regulate wetland activities is derived from Section 10 of the River and Harbor Act of 1899 and Section 404 of the Water Pollution Control Act Amendments of 1972. The rules followed in evaluating permit applications for dredge and fill operations are explained. If a wetland serves one or more of the functions considered important, no permit affecting that wetland will be granted unless the benefits of the proposed alteration outweigh the damage to the wetland rsource and the proposed alteration is necessary to realize those benefits. the significant difference between Corps projects and regulated private activities is that a less broad public interest review criteria is applied to Corps projects. The Corps' wetlands policy and EPA guidelines, reasonably and sensitively applied, provide a means of limiting the alteration or destruction of wetlands to that which is truly in the public interest. (See also W80-02253) (Howard-Mass)
W80-02275

EPA'S WETLAND RELATED PROGRAMS,
Department of Justice, Washington, DC.
V. Hughes.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 133-137, 1978. 1 Tab, 1 Append.

Descriptors: *Federal government, *Programs, *Wetlands, *Preservation, Administrative agencies, Permits, Legislation, Local government, State government, Water resources development, Regulation, land use, Dredging, Land fill, Federal project policies.

Several programs implemented by the Environmental Protection Agency that directly or indirectly affect the Nation's wetlands are reviewed. A partnership between the Federal Water Pollution Control Act Section 404 Program and State and local government appears to act effectively in wetland protection in many States. All of the various approaches to wetland protection, from technical assistance through regulatory programs, are needed to achieve some measure of improved decision-making concerning this important part of our aquatic resources. The local, state, and national perspectives should be brought together when maing management decisions. (See also W80-02253) (Howard-Mass)
W80-02276

WETLAND DEVELOPMENT, AN ALTERNATIVE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 6A.
W80-02277

GRASSROOTS CONSERVATION OF WETLANDS: THE SANIBEL LAND USE PROGRAM,
Conservation Foundation, Washington, DC.
J. Clark.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 153-162, 1978. 6 Fig, 1 Tab, 2 Ref.

Descriptors: *Wetlands, *Preservation, *Florida, *Legislation, *Local governments, Regulation, Land use, Water resources development, Salt marshes, Freshwater marshes.

Wetlands protection in the City of Sanibel, Florida, is provided by city ordinances. It is accomplished by designating the interior (Spartina) and mangrove wetlands as zones of special ecological significance, allowing only certain uses in wetlands, restricting the density of those uses, and requiring strict performance standards on implementing the uses. This conservation program is based on an innovative method of guaranteeing that uses are restricted to a level and type that would have minimal adverse ecological impact. (See also W80-02253) (Howard-Mass)
W80-02279

THE APALACHICOLA DILEMMA: WETLANDS PRIORITIES DEVELOPMENTAL STRESS, AND MANAGEMENT INITIATIVES,
Florida State Univ., Tallahassee. Dept. of Biological Science.
R. J. Livingston.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 163-177, 1978. 10 Fig, 21 Ref.

Descriptors: *Wetlands, *Preservation, *Florida, *Alabama, *Georgia, Legislation, Programs, Freshwater marshes, Salt marshes, State governments, Federal government, Land use, Environmental effects, Drainage, Channeling, Water resources development, Impoundments.

The Apalachicola drainage system in the States of Alabama, Georgia, and Florida includes an extensive array of unspoiled freshwater and estuarine wetlands. It sustains important terrestrial and aquatic biotic associations characterized by high species richness and endemism and a number of rare and endangered species. The estuarine productivity is closely associated with the natural functions of the river and the habitats formed by the barrier island system. Recently introduced or proposed wetland projects including cattle ranching, forestry operation, barrier island development, impoundment and/or channelization of the river, and industrialization of the flood plain could have serious implications for the high productivity of the region. A management strategy for the Apalachicola system is based in part on the application of State laws and Federal regulations and involves preservation of environmentally sensitive lands, determination of key economic and environmental alternatives, and implementation of various environmental programs. The Apalachicola situation represents a unique opportunity for the application of research, education, state and federal regulation, and local planning initiatives to the development of a comprehensive management program for an entire wetlands system. (See also W80-02253) (Howard-Mass)
W80-02280

WETLANDS AND THE TAKING ISSUE,
Conservation Foundation, Washington, DC.
J. S. Banta.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 179-183, 1978.

Descriptors: *Wetlands, *Legal aspects, *Jurisdiction, *Public rights, Governments, Administrative agencies, Economics, Water resources development, Easements, Competing uses, Preservation.

Wetlands are a type of property frequently subject to the navigation servitude, public trust, or another competing public interest. The taking issue, derived from state and Federal Constitutional law, is discussed along with several other related issues.The cast and direction of both legislative policy and current litigation will heavily influence the options open to the scientists and managers of our wetlands in the future. (See also W80-02253) (Howard-Mass)
W80-02281

LESSONS FROM A WET STATE,
Conservation Law Foundation of New England, Inc, Boston, MA.
A. D. Dawson.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 185-195, 1978.

Descriptors: *Wetlands, *Preservation, *Legislation, Public rights, Legal aspects, Hazards, Jurisdiction, Governments, Water resources development, Land use, Zoning, Regulation.

The outcome of 'taking issue' cases in Massachusetts seems to depend upon which end of the problem--protecting the public interest or protecting the private landowner--is first approached by the particular judge. The argument most likely to prevail against private rights is the prevention of public hazard. Local zoning is an acceptable way to protect the flood plains and wetlands, whether or not statewide statutes exist. In individual cases, local officials or State officials may prove more able to resist pressures to develop wetlands, but in some cases only the Federal government will be able to rise above the pressure. From the environmental viewpoint, the best system is the one which offers a system of vetoes, not overriding votes, on the local, state, and federal level. Government, on any level, has no 'constitutional' right to use its land in any particular way, especially in contravention of public policies laid out in constitutions, statutes, or executive orders. The scope of state and federal servitudes over navigable waters, tidal and inland, is growing. One implication of the doctrine appears to be that land may belong to private persons, but the water belongs to the public. (See also W80-02253) (Howard-Mass)
W80-02282

LEGAL AND POLITICAL ISSUES,

Munger, Tolles, Hills, and Rickershauser, Los Angeles, CA.
P. R. Taft.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 197-200, 1978.

Descriptors: *Wetlands, *Federal government, *Legal aspects, *Preservation, *Political aspects, Jurisdiction, Water resources development.

The historical development and bases of the Federal government's power over the waters of the United States are traced. A serious problem in enforcement of Federal programs exists. The development of a substantial local effort, both public and private, is necessary to support the Army Corps of Engineers projects. The lack of public awareness of what is at stake and the still rudimentary knowledge of the interdependency of our ecosystems are larger issues which affect legal, enforcement, and political problems in the area of wetland protection. (See also W80-02253) (Howard-Mass)
W80-02283

WETLANDS, TAXATION, AND THE TAKING ISSUE,
Environmental Law Inst., Washington, DC.
C. C. Harwood.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 201-203, 1978.

Descriptors: *Wetlands, *Taxes, *Preservation, Local government, State government, Water resources development, Land use, Regulation.

Land taxing policies can be used to help avoid the issue of taking, to provide incentives to landowners for wetland protection, and to supplement and enhance legislative policy decisions to protect wetlands. Local government must take the initiative to reassess properties subject to regulations restricting development. To encourage this, States should provide them with maps that indicate wetlands subject to development restrictions. States should also encourage the use of voluntary conservation restrictions and require that their impact on land values be reflected in property assessments. At the same time, private property owners should be educated and encouraged to take advantage of laws that promote wetland protection in exchange for real property income, estate, and gift tax advantage. (See also W80-02253) (Howard-Mass)
W80-02284

MITIGATION: A CONCEPT FOR WETLAND RESTORATION,
Oregon State Dept. of Land Conservation and Development, Salem.
E. T. LaRoe.
In: Proceedings of the National Wetland Proection Symposium, June 6-8, 1977, Reston, virginia, p 221-224, 1978.

Descriptors: *Estuarine environment, *Preservation, *Legislation, *Oregon, Salt marshes, Wetlands, Dredging, Landfill, Ecological effects, Ecology, State governments.

Dredge, fill, or other reduction or degradation of the natural value of estuarine ecosystem is allowed by Oregon's Land-Use Program only if such activities are required for navigation or other water dependent uses that require an estuarine location, if a public need is demonstrated, if no alternative upland locations exist, and if adverse impacts are minimized as much as possible. When dredge or fill activities are permitted, their effects must be mitigated by creation or restoration of another area of similar biological potential to ensure that the integrity of the estuarine ecosystem is maintained. This requirement is intended to provide an area that will, with time, develop a qualitatively and quantitatively similar flora and fauna. The highest priority areas for creation or restoration are those in the general proximity to the fill or dredge site. If such areas are not available, areas in other parts of the estuary may be selected according to the similarity of salinity regime, tidal exposure and elevation, substrate type, current velocity and patterns, orientation to solar radiation, and slope. The third priority for mitigation is to restore areas or resources which are presently in the greatest scarcity compared to their past abundance and distribution. (See also W80-02253) (Howard-Mass)
W80-02288

PUBLIC INVOLVEMENT IN WETLAND PROTECTION DOES MAKE A DIFFERENCE.
Massachusetts Audubon Society, Lincoln.
J. Colman.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 229-232, 1978. 1 Append.

Descriptors: *Wetlands, *Preservation, *Massachusetts, *Local governments, Political aspects, Regulation, Permits, Publications, Legislation.

Wetland protection is basically a political process which requires educated public involvement in order to succeed. At the local level, many citizens feel they will be taken seriously and so have incentive to participate in protection efforts. Massachusetts has a good model for building public involvement into the wetland regulatory process. (See also W80-02253) (Howard-Mass)
W80-02290

PUBLIC PROCESSES AND PUBLIC INVOLVEMENT IN WETLAND REGULATORY PROGRAMS,
Connecticut Dept. of Environmental Protection, Hartford.
A. N. Williams.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 233-241, 1978 3 Fig, 2 Tab, 5 Ref.

Descriptors: *Wetlands, *Regulation, *Programs, Permits, Connecticut, Massachusetts, Preservation, Administrative agencies, Water resources development.

To date, public involvement in wetland regulation has concerned itself primarily with the passage of wetland acts. The public does not involve itself with overseeing regulatory agencies and is therefore writing off many valuable wetlands. Public regulatory agencies find it difficult to educate the public in wetland values, or to actively solicit public involvement in regulatory affairs because of financial or political restraints. A mechanism must be initiated which will mandate incorporation of citizen input into the regulatory and management processes and develop technical capability throughout a region. (See also W80-02253) (Howard-Mass)
W80-02291

STREAM CHANNELIZATION (P.L. 83-566) INCREASED WETLAND LOSSES IN THE DAKOTAS,
Fish and Wildlife Service, Bismark, ND.
R. E. Erickson, R. L. Linder, and K. W. Harmon.
Wildlife Society Bulletin, Vol 7, No 2, p 71-78, Summer, 1979. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Channeling, *Wetlands, *Environmental effects, *North Dakota, *South Dakota, Streams, Channel improvement, Drainage, Ecology, Watershed management, Water resources development, Legislation, Legal aspects, Political aspects, Cost sharing, Flood protection, Federal project policies.

Stream channelization under the Small Watershed Program (P.L. 83-566) was the major influence on wetland drainage in the Wild Rice Creek Watershed in North and South Dakota. Drainage rates were 2.6 times higher in the channeled area than in the unchanneled area during project planning and 5.3 times higher during and following construction. Although the channel's claimed benefits were watershed protection and flood control, the channel permitted and stimulated wetland drainage deleterious to wildlife. Substantial legal, policy, and administrative changes are necessary to prevent such habitat loss. Basic in any change is an overriding consideration of public values, such as wildlife, when public funds are involved, with cost-sharing rates that reflect and promote this concern. Especially when wetlands are present, base acreages need to be established early in project planning, and the sponsor should be required to show how wetlands will be protected as a condition for receiving public funds. Recent executive orders and policy guidelines on wetlands and channelization express a national concern for wetlands and may be helpful, but do not address fundamental cost-share issues and therefore are not believed to be adequate to protect wetlands in these projects. (Howard-Mass)
W80-02300

6F. Nonstructural Alternatives

MANAGEMENT OF RECREATIONAL FISHERIES IN NORTHERN QUEBEC: POLICIES VERSUS TOOLS,
Brock Univ., St. Catharines (Ontario). Inst. of Urban and Environmental Studies.
For primary bibliographic entry see Field 6E.
W80-02138

WETLAND VALUES,
Connecticut Coll., New London.
For primary bibliographic entry see Field 6B.
W80-02255

THE NATIONAL FLOOD INSURANCE PROGRAM AND WETLAND PROTECTION,
Federal Flood Insurance Administration, Washington, DC.
R. W. Krimm.
In: Proceedings of the National Wetland Protecton Symposium, June 6-8, 1977, Reston, Virginia, p 123-125, 1978.

Descriptors: *Wetlands, *Preservation, *Flood protection, *Insurance, Values, Flood damage, Programs, Administrative agencies, Coastal marshes, Marshes, Landfills, Federal project policies.

The National Flood Insurance program (NFIP) was designed to reduce loss of life and property from floods. Part of the program's responsibility involves the development and enforcement of floodplain management standards to reduce flood damages. Regulation recently adopted requires that communities wishing to qualify for the program protect mangrove stands and dunes which act as barriers to storm surges. The program also indirectly protects wetlands in several ways. It establishes disincentives for location of structures in areas of known flood risk, prohibits the use of fill for elevation purposes in identified coastal high hazard areas, and encourages use of columns for elevation to minimize the use of fill. A discussion is provided of the recent wetland and floodplain executive orders and their relations to the NFIP. (See also W80-02253) (Howard-Mass)
W80-02274

WETLANDS, TAXATION, AND THE TAKING ISSUE,
Environmental Law Inst., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-02284

THE ROLE OF THE PRIVATE SECTOR IN WETLAND PROTECTION,
Nature Conservancy. Arlington, VA.
L. G. Low.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 225-228, 1978.

Descriptors: *Wetlands, *Preservation, *Public lands, Land use, Legislation, Legal aspects.

The private sector must provide a stimulus for public action in the preservation of wetlands and other natural areas through legislation, lobbying, and litigation activities. The private sector can also

take direct action to fill the gaps that exist in the public sector and to set a model for the public sector to follow. The Nature Conservancy, a national non-profit membership organization, takes such direct action through the acquisition of land by direct purchase, gifts, and by working in cooperation with public agencies. (See also W80-02253) (Howard-Mass)
W80-02289

6G. Ecologic Impact Of Water Development

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: MAIN REPORT.
California Region Framework Study Committee.
For primary bibliographic entry see Field 6B.
W80-02033

SHORT AND LONG-TERM IMPACTS OF THE RIVER NILE PROJECTS,
Water Management and Irrigation Technologies Research Inst. Cairo (Egypt).
M. Abu-Zeid.
Water Supply and Management, Vol 3, No 4, p 275-283, 1979. 4 Tab.

Descriptors: *Environmental effects, *Water distribution(Applied), *Water supply development, *Water storage, *Water demand, *Dams, *Reservoirs, Floods, Droughts, Fisheries, Water quality, Public health, Potential water supply, Silting, River basin development, Water management(Applied), Dependable supply, Water utilization, Storage requirements, Feasibility studies, Egypt, Nile River, Aswan High Dam.

A detailed examination of Egypt's supplies and demands for water indicates that the Nile River has been and still is the principal factor in the development of this arid country. Full control of Nile Water depends, however, on the Aswan High Dam, completed in 1968 which has created the huge long-term, man-made reservoir, Lake Nasser. The execution of this dam, a scheme of colossal dimensions calling for heavy expenses and enivisaging far off objectives was preceded by extensive feasibility studies and has had both positive and negative effects. These effects which include protection against high floods and droughts, and such agricultural and environmental impacts as siltation of lakes, degradation downstream, loss of silt on agriculture, impacts on fisheries, water quality changes and public health impacts, form the basis of this paper. It is felt that the negative effects are far outweighed by benefits so far accrued. (Tickes-Arizona)
W80-02206

THE BIOLOGY OF SALT WELLS CREEK AND ITS TRIBUTARIES, SOUTHWESTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. J. Engelke, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-300828, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-121, 1978. 82 p, 43 Fig, 15 Tab, 22 Ref.

Descriptors: *Aquatic life, *Biological communities, *Ecosystems, *Water quality, *Water baseline studies, Streams, Wyoming, Food chains, Benthic fauna, Invertebrates, Benthic flora, Nutrients, Water analysis, *Green River basin(Wyo), *Salt Wells Creek basin(Wyo).

A description of aquatic organisms and biological communities is presented for Salt Wells Creek, a plains stream in the Green River basin. The description includes seasonal population fluctuations of benthic organisms and algae, the food pyramid, and nutrient relations between various types of plants and animals. The algae and stream invertebrates were studied to determine baseline data and biological indicators of water quality. (Woodard-USGS).
W80-02232

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
For primary bibliographic entry see Field 6E.
W80-02253

THE HAZARDS OF WETLANDS USE,
Colorado Univ., Boulder. Inst. of Behavioral Science.
For primary bibliographic entry see Field 6E.
W80-02254

OVERVIEW OF MAJOR DEVELOPMENT IMPACTS ON WETLANDS,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 6B.
W80-02257

CRITICAL WETLANDS ACQUISITION: WISCONSIN SCIENTIFIC AREAS,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 6E.
W80-02268

SAN FRANCISCO BAY: THE WETLANDS BESEIGED,
J. W. Hedgpeth.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 143-152, 1978. 6 Fig, 15 Ref.

Descriptors: *Salt marshes, *Preservation, *California, Programs, Bays, Wetlands, Land use, Landfill, Dikes, Environmental effects, Mine wastes.

A historical outline is provided of land use surrounding the marshes of San Francisco Bay and its delta. Much of the bay's marshland had been filled or diked off and a considerable alteration in the natural fauna had occurred by 1960. The development and wetland protection efforts of the Bay Conservation and Development Commission are discussed. (See also W80-02253) (Howard-Mass)
W80-02278

PROMISED LANDS, VOLUME 2: SUBDIVISIONS IN FLORIDA'S WETLANDS,
L. Allan, B. Kuder, and S. L. Oakes.
Inform, Inc., New York, NY. 1977. 542 p.

Descriptors: *Florida, *Wetlands, *Environmental effects, *Drainage, Effects, Economic, Pollutants, Marshes, Swamps, Sewage, Subdivisions.

Environmental and consumer impact of nine Florida subdivisions owned by five companies were examined. Two, both initiated in the 1970s, are well-planned using environmentally sound principles. Several developments, however, have had a devastating impact on the environment. These subdivisions have destroyed thousands of acres of valuable fish breeding grounds and wildlife habitat, polluted surrounding waters and created a desolate and sterile environment for future site residents. Separate chapters discuss subdivisions in the 1950s (Port Charlotte and Cape Coral), 1960s (Marco Beach and Silver Springs Shores) and the 1970s (Palm Coast, Citrus Springs and Pine Ridge, Poinciana and Port LaBelle). An appendix discusses guidelines for consumer and environmental protection practices at large-scale subdivisions. A glossary is provided. (Stihler-Mass)
W80-02314

MICHIGAN COASTAL WETLANDS: WHAT GOOD ARE THEY.
For primary bibliographic entry see Field 2I.
W80-02315

AN OVERVIEW OF ST. JOHN'S MARSH, ST. CLAIR COUNTY, MICHIGAN.
Booklet II, MICH U--SG--79--503, March, 1979. 8 p, 2 Fig. Michigan Sea Grant Communications, Ann Arbor, MI.

Descriptors: *Freshwater marshes, *Coastal marshes, *Michigan, Wetlands, Wildlife, Fish, Drainage, Utilities, Protection, St. John's Marsh(MI).

St. John's Marsh, one of the few remaining marshes on Lake St. Clair, provides habitat for wildlife and lake fish. Developers have turned some sections of the marsh into residences and have plans to develop other parts of the marsh. Clay-Township has zoned the marsh for planned residential development; however, many nature and conservation organizations are opposed to this zoning. Planners must consider all public interests when they make final management plans for the marsh. (Stihler-Mass)
W80-02316

LAND MANAGEMENT ALTERNATIVES FOR ST. JOHN'S MARSH, ST. CLAIR COUNTY, MICHIGAN.
Booklet III, MICH U--SG--79--504, March, 1979. 16 p, 6 Fig. Michigan Sea Grant Communications, Ann Arbor, MI.

Descriptors: *Freshwater marshes, *Coastal marshes, *Michigan, *Environmental effects, *Planning, Wetlands, Marshes, Recreation, Wildlife, Urbanization, Fish, Economics, Protection, Lake St. Clair, St. John's Marsh(MI).

Four management alternatives for St. John's Marsh are outlined. These are: Full protection as a wildlife and fish sanctuary, Development into a state recreation area, and partial, and full residential development. All positive and negative aspects of each alternative need consideration when management plans are made. (Stihler-Mass)
W80-02317

THE EFFECTS OF MOWING ON THE DYNAMICS OF QUANTITY, BIOMASS AND MINERAL CONTENTS OF REED (PHRAGMITES COMMUNIS TRIN.),
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
H. Mochnacka-Lawacz.
Polskie Archiwum Hydrobiologii, Vol 21, No 3/4, p 381-386, 1974. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Marsh plants, *Nutrient requirements, *Plant physiology, *Cutting management, Wetlands, Lakes, Biomass, Plant growth, Nutrients, Calcium, Phosphorus, Marsh management.

The mowing of reed three times during a growing season significantly lowered its biomass, quantity, and percentage of leaves in biomass of sprouting plants. The pattern of seasonal changes of particular mineral ingredients in mown and unmown reed were similar, but the amounts of accumulated substances were different. Elements typical of old plants (ash, silica, calcium) were more abundant in unmown than in mown reed. In the latter, a large proportion of elements typical of young plants was observed (potassium, phosphorus, nitrogen). (Steiner-Mass)
W80-02318

DEVELOPMENT OF SOME LAKE ECOSYSTEMS IN TROPICAL AFRICA, WITH SPECIAL REFERENCE TO THE INVERTEBRATES,
Newcastle-upon-Tyne Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 2I.
W80-02325

EFFECTS OF PEAT UTILIZATION ON WATER QUALITY IN MINNESOTA,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
R. L. Crawford.
Submitted to Minnesota Department of Natural Resources, March, 1978. 18 p, 10 Tab.

Descriptors: *Peat, *Minnesota, *Environmental effects, *Literature, Wetlands, Bogs, Lakes, Water quality, Algae, Nutrients, Metals, Aquatic life.

A literature survey was conducted on experimental work examining: (1) the micronutrients found in typical peatland waters, (2) the effects of bog humic substances on plants and animals receiving waters, and (3) the ability of peat to adsorb metals and other ionic species. In addition, some experiments were done to examine the effect of bog water on algal growth and photosynthesis in lake water. Results indicated that the addition of bog water to nutrient poor northern Minnesota lakes may result in increased algal growth. (Steiner-Mass)
W80-02327

7. RESOURCES DATA

7A. Network Design

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
For primary bibliographic entry see Field 6E.
W80-02253

TECHNIQUES DEVELOPED AND PRESENTLY BEING USED TO CONDUCT THE NATIONAL WETLAND INVENTORY PROJECT,
Fish and Wildlife Service, St. Petersburg, FL. Office of Biological Services.
For primary bibliographic entry see Field 7C.
W80-02285

WETLANDS MAPPING FROM THE LOCAL PERSPECTIVE,
Massachusetts Audubon Society, Lincoln.
For primary bibliographic entry see Field 7C.
W80-02286

PROGRAM AND PRIORITIES FOR WETLAND RESEARCH DEVELOPED BY THE NATIONAL WETLANDS TECHNICAL COUNCIL,
Massachusetts Univ., Amherst.
J. S. Larson, O. Loucks, and J. Clark.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 243-244, 1978.

Descriptors: *Wetlands, *Research and development, *Programs, *Priorities, Preservation, Management, Ecosystems, Data collections, Data processing, Value, Rehabilitation, Water resources development, Assessments.

Major national and regional research questions should be identified and delineated in the context of the functionally based wetland types recognized by the U. S. Fish and Wildlife Service. This will lead to an ongoing mechanism for identifying gaps in the knowledge of specific functional values of wetlands by type and by region. Other areas for near-term research dealing with wetlands include strengthening or establishing national and regional centers for accumulation of information and data exchange, and review and evaluation of the primary technical elements underlying national and international policy concerning wetland conservation. Long-term project needs include: basic research on the dynamics of natural wetland processes and functions, to be considered as a part of a national program of comparative studies of wetland systems; functional assessment of wetlands as units of the landscape; priorities for applied research on the impacts of wetland alteration; and advancement of the understanding of the social significance of wetlands. Special studies should be advanced on the principles of wetlands rehabilitation and restoration, recognition of restoration opportunities, and rehabilitation of the sites of surface mining in wetlands. (See also W80-02253) (Howard-Mass)
W80-02292

SOME RESEARCH PRIORITIES,
Connecticut Coll., New London.
W. A. Niering.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 245-246, 1978 2 Ref.

Descriptors: *Wetlands, *Research and development, *Priorities, Marshes, Salt marshes, Freshwater marshes, Tidal marshes, Succession, Ecology, Vegetation, Rehabilitation, Water resources development.

An investigation is needed on the interplay of hydroperiod, tidal subsidy, salinity, nutrients, oxygen, temperature, microrelief, and substrate conditions and its effect on vegetation types encountered in tidal marshes. A careful scrutiny should be made on the role of successional concepts in interpreting wetland dynamics. High marsh reconstruction and marsh rehabilitation are also priority areas for wetlands research. (See also W80-02253) (Howard-Mass)
W80-02293

RESEARCH PRIORITIES: COASTAL MUD FLATS AND TIDAL FRESHWATER WETLANDS,
Virginia Inst. of Marine Science, Gloucester Point.
E. M. Silberhorn.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 247-249, 1978 6 Ref.

Descriptors: *Tidal wetlands, *Mud flats, *Research and development, *Preservation, Wetlands, Tidal effects, Intertidal areas, Ecosystems, Algae, Productivity, Management.

The salt marsh, mud flat, and the estuary must be considered as portions of a horizontal stratified system. Area differences among these portions alter the potential contribution of each strata to the total ecosystem under regimes of differing tidal amplitude. Research should be directed toward qualitatively identifying and quantitatively determining ecological processes of the mud flat component. There is also limited basic information concerning tidal freshwater wetlands, which have great importance to the marine environment as spawning and nursery areas for alosa fish, to aid in management decisions. These areas are threatened by high wave energy due to boat traffic and the disturbance of normal sedimentation patterns by dams. (See also W80-02253) (Howard-Mass)
W80-02294

7B. Data Acquisition

TECHNIQUES DEVELOPED AND PRESENTLY BEING USED TO CONDUCT THE NATIONAL WETLAND INVENTORY PROJECT,
Fish and Wildlife Service, St. Petersburg, FL. Office of Biological Services.
For primary bibliographic entry see Field 7C.
W80-02285

THE QUANTITATIVE MEASUREMENT OF FOG AND RIME DEPOSITION USING FOG-GAUGES,
Tornado and Storm Research Organization, Trowbridge (England).
For primary bibliographic entry see Field 2B.
W80-02333

DETECTION METHODS FOR LOCATION OF SUBSURFACE WATER AND SEEPAGE,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W80-02334

7C. Evaluation, Processing and Publication

SYNTHETIC HYDROLOGIC INFORMATION--A CASE STUDY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2E.
W80-02185

EVIDENCE OF ACIDIFICATION OF HEADWATER STREAMS IN THE NEW JERSEY PINELANDS,
Pennsylvania Univ., Philadelphia.
For primary bibliographic entry see Field 5B.
W80-02190

QUALITY OF UNTREATED WATER FOR PUBLIC SUPPLIES IN FLORIDA WITH REFERENCE TO THE NATIONAL PRIMARY DRINKING WATER REGULATIONS,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. W. Hull, and G. A. Irwin.
Florida Bureau of Geology Map Series No 91, 1979. 1 Sheet, 1 Fig, 2 Tab, 12 Ref.

Descriptors: *Florida, *Water quality, *Water supply, *Potable water, Surface waters, Groundwater, Aquifers, Maps, Water analysis, Chemical analysis, Water quality standards, *Untreated water.

This map report shows that virtually all the public supply waters sampled during the August-September 1976 reconnaissance in Florida meet the standards as set forth in the 'National Primary Drinking Water Regulations.' About 130 major public water supplies were sampled for both treated and untreated waters to determine baseline concentrations for those chemical and physical parameters for which maximum contaminant levels were established in the regulations. Several thousand more public supplies exist in the five main aquifers and surface sources than were sampled during this reconnaissance making this only a general overview of the water quality. Results of the water-quality analyses for the untreated samples are summarized by individual parameter on small statewide maps with a discussion of the concentration ranges and potential exceedances in the accompanying text. (Woodard-USGS).
W80-02241

WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1978--VOLUME 1. GREAT LAKES AND SOURIS-RED-RAINY RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-117518, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MN-78-1, June 1979. 300 p, 7 Fig.

Descriptors: *Minnesota, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Lake Superior tributaries(Minn), *Red River of the North basin(Minn), *Lake of the Woods basin(Minn).

Water resources data for the 1978 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the Great Lakes and Souris-Red-Rainy River basins, and contains discharge records for 77 gaging stations; stage only records for 1 gaging station; stage and contents for 5 lakes and reservoirs; water quality for 19 gaging stations, 1 partial-record station, 4 lakes, and 20 wells; and water levels for 30 observation wells. Also included are 42 crest-stage partial-record stations and 17 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (Woodard-USGS).
W80-02246

WATER RESOURCES DATA FOR WASHINGTON, WATER YEAR 1978--VOLUME 2. EASTERN WASHINGTON.

Geological Survey, Tacoma, WA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-117526, Price codes: A19 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WA-78-2, June 1979. 360 p, 19 Fig.

Descriptors: *Washington, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Eastern Washington.

Water resources data for the 1978 water year for Washington consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 248 gaging stations, stage only at 4 gaging stations, stage and contents at 44 lakes and reservoirs, water quality at 117 gaging stations (including 6 lakes and reservoirs) and 215 wells, and water levels at 166 observation wells. Also included are data for 96 crest-stage, and 89 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volume 1 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Washington. (Woodard-USGS).
W80-02247

WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1978--VOLUME 2. UPPER MISSISSIPPI AND MISSOURI RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-117625, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MN-78-2, June 1979. 425 p, 9 Fig, 1 Tab.

Descriptors: *Minnesota, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Upper Mississippi River basin(MN), *Missouri River basin(MN).

Water resources data for the 1978 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the upper Mississippi and Missouri River basins and contains discharge records for 75 gaging stations; stage and contents for 9 lakes and reservoirs; water quality for 35 gaging stations, 1 partial-record station, 24 lakes, and 59 wells; and water levels for 119 observation wells. Also included are 102 crest-stage partial-record stations and 49 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (Woodard-USGS).
W80-02248

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
For primary bibliographic entry see Field 6E.
W80-02253

TECHNIQUES DEVELOPED AND PRESENTLY BEING USED TO CONDUCT THE NATIONAL WETLAND INVENTORY PROJECT,
Fish and Wildlife Service, St. Petersburg, FL. Office of Biological Services.
J. H. Montanari, and B. O. Wilen.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 205-212, 1978.

Descriptors: *Wetlands, *Mapping, *Photogrammetry, *Research and development, Values, Federal government, Economics, Management, Surveys, Application methods, Design, Water resources development.

The National Wetlands Inventory is designed to provide a single, universally applicable system of wetland information which will describe all wetlands on an individual and/or cumulative basis in terms of their ecological and physical characteristics, geographical location, and natural resource values. The existing data, information, and techniques used to meet the goals of the project are discussed. The Wetlands Analytical Mapping System was developed to record the latitude and longitude of the data points and to allow the wetland information to be changed to any required map scale and map projection. The inventory product will aid in the determination of flood control, groundwater, coastal storm damage proection, wildlife, shellfish, finfish, and tertiary waste treatment values of wetland. (See also W80-02253) (Howard-Mass)
W80-02285

WETLANDS MAPPING FROM THE LOCAL PERSPECTIVE,
Massachusetts Audubon Society, Lincoln.
E. Kline.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 213-215, 1978.

Descriptors: *Wetlands, *Mapping, *Massachusetts, Land use, Legislation, Preservation, Maps, Political aspects, Local governments.

It pays in time, money, and wetlands protection for a wetlands map to be drawn to meet specific needs. In Massachusetts, wetlands maps must be based on vegetation because their major use is to aid in administering a law which defines wetlands according to plants. Some field checking is necessary for the maps to be useful at the site-specific level. Politics play a role in determining the map's purpose, content, degree of accuracy, and use. (See also W80-02253) (Howard-Mass)
W80-02286

HURST PHENOMENON AS A PRE-ASYMPTOTIC BEHAVIOR,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-02332

A STUDY OF THE PERSISTENCE OF SOME WATER-QUALITY PARAMETERS (ETUDE DE LA PERSISTANCE DE QUELQUES PARAMETRES DE QUALITE DE L'EAU),
Institut National de la Recherche Scientifique, Rimouski (Quebec).
B. Bobee, and D. Cluis.
Journal of Hydrology, Vol 44, No 1/2, p 17-36, November 1979. 3 Fig, 8 Tab, 5 Ref.

Descriptors: *Water quality, *Watersheds(Basins), *Sampling, *Runoff, Analytical techniques, Statistical methods, Ions, Silica, Nitrates, Phosphates, Water sampling, Frequency, Frequency analysis, Analysis, Correlation analysis, Time series analysis, Gaging stations, On-site data collections.

From 1967 to 1975 the water quality service of the Quebec Department of Natural Resources collected 16,000 water samples at 250 stations; in 1975 the number of stations in operation had been reduced to 66 obtained cannot be analyzed by such classical and sophisticated methods as spectral analysis. In order to make use of these date, some less sophisticated, although adequate, methods were considered. In this way, the persistence of several parameters (major ions, silica, nitrate, phosphate) was studied by analyzing the autocorrelation of weekly and monthly series of data and by considering their information content. This technique, based on the analysis of historical data, will indicate the optimal sampling frequencies relative to the types of parameters as well as the hydrographical regions under investigation. (Humphreys-ISWS)
W80-02359

8. ENGINEERING WORKS

8A. Structures

ROMAN DAMS,
Motor-Columbus Consulting Engineers, Inc., Baden(Switzerland).
N. J. Schnitter.
Water Supply & Management, Vol 3, No 1, p 29-39, 1979. 12 Fig, 29 Ref.

Descriptors: *Dams, *Roman dams, *Dam design, *Masonry dams, *Arch dams, *Buttress dams, *Gravity dams, *Rock fill dams, *North Africa, *Roman Empire, *Italy, Dam construction, Excavation, Dam foundations, Dam sites, Earth dams, Earthworks, Reservoirs, Retaining walls.

The author describes the most typical and important PreRoman and Roman dam works in the Mediterranean and Near East areas. The different dams described are divided into one of three types: earth or rock fill, gravity or buttress, and arch. The Subiaco dam was the highest structure built by the Romans and also seems to be their only use of dam engineering in Italy. Roman dams in North Africa are supported by either earth fills or buttresses. Dams up to 7 m high and 900 m long were used in wide and flat valleys and were provided at their two ends with spillways of solid masonry. Especially noteworthy gravity dams were built in the Wadi Megenin 40 km south of Tripoli and they consisted of boulders from the river bed or blocks from quarries laid in mortar. Their vertical upstream faces are carefully plastered while the downstream faces are steeply stepped. These dams are up to 5 m high and have almost rectangular cross-sections of generally ample base width. Oued Derb dam near Kasserine in Tunisia is probably the largest Roman gravity dam in North Africa. North African dams, besides serving to store and/or divert water for irrigation or water supply, were used to retain sediments in order to gain arable land in the wadis. The dam in the Vallon de Baume south of Saint-Remy deProvence in southeastern France was the first application in dam engineering in the area. Roman dam technology, through the capturing of ideas during wars, penetrated far to the East (in the 2nd Century) which took the leadership in this field for many centuries. (Iervolino-NC)
W80-02025

LEAK DETECTION: MODERN METHODS, COST, AND BENEFITS,
East Bay Municipal Utility District, Oakland, CA.
For primary bibliographic entry see Field 6B.
W80-02136

LOW COST, LABOR INTENSIVE COASTAL DEVELOPMENT APPROPRIATE TECHNOLOGY,
For primary bibliographic entry see Field 6C.
W80-02142

SALTWATER-BARRIER LINE IN FLORIDA: CONCEPTS, CONSIDERATIONS, AND SITE EXAMPLES,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5G.
W80-02237

AUTOMATIC WATER-LEVEL CONTROL IN SOUTH AFRICA,
Department of Water Affairs, Pretoria (South Africa).

K. Merensky, and D. Hopkins.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY11, Proceedings paper 14992, p 1415-1432, November 1979. 14 Fig, 8 Ref, 1 Append.

Descriptors: *Dams, *Gate control, *Water levels, *Automation, Control, Flood control, Discharge(Water), Water level fluctuations, Maximum probable flood, Gates, Control structures, Control systems, Flood routing, Reservoirs, Reservoir operation, *South Africa.

The principle of proprtional, integral, and derivative sensing constituted the therme of this paper. A study was made of the different types of control elements involved. This resulted in the selection of a PID-controller as the most suitable. This controller was designed and installed, and three different methods were employed for determining the optimum parameter settings. These comprise direct calculation, analog computer simulation, and actual practical tests on site. The final parameter settings resulted in efficient and effective automatic water-level cntrol to within a spectrum of 1.18 in. - 1.57 in. at full supply level at incoming flows and floods ranging from 285 cfs-25,000 cfs (8 cu m/s-700 cu m/s). These results were due to the mechanism actually reacting to a water-level change of as small as 1 mm. (Sims-ISWS)
W80-02341

8B. Hydraulics

EFFECTIVENESS OF VARIOUS SAND AND GRAVEL SEPARATES FOR DRAIN ENVELOPES,
California Univ., Davis. Water Science and Engineering Section.
J. N. Luthin.
In: 'Factors Influencing Water and Particle Movement Into Drains,' Agricultural Research (Western Region), Science and Education Administration, U.S. Dept. of Agriculture, ARR-W-8, p 33-42, June 1979, 1 Fig, 4 Tab, (California Water Resources Center Project UCAL-WRC-W-212), OWRT-A-031-Cal(4).

Descriptors: *Drainage engineering, *Sands, *Gravels, *Well filters, Wells, Subsurface drainage, Drainage, Particle size, Tile drainage.

This study tested the effectiveness of various sand and travel separates in gravel envelopes. Some design criteria that governmental agencies use for drain envelopes were developed for gravel packs around wells. Although flow around a well is similar to that around a drain, flow is much faster near a well, and the lower amount of gravel required allows the use of a more expensive type of gravel envelope. The carefully graded envelope that is possible around a well is too expensive for an on-farm drainage system. The study reported here tested various envelope materials under conditions simulating those in the vicinity of a subsurface drain line, such as a tile drain. (Snyder-California)
W80-02076

PLANE TURBULENT WALL WAKES,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam, and S. P. Rai.
Journal of the Engineering Mechanics Division, American Society of Civil Engineers, Vol 105, No EM5, Proceedings Paper 14882, p 779-794, October 1979. 10 Fig, 1 Tab, 16 Ref, 2 Append.

Descriptors: *Boundary layers, *Fluid mechanics, *Walls, Hydraulics, Shear stress, Turbulent flow, Distribution, Velocity, Equations, Mathematical studies, Mathematics, Model studies, *Wakes, Velocity profile, Two-layer fluid model, Wind tunnel, Wall shear.

This paper presented a two-layer model to describe the velocity profiles in the far-wake region of plane turbulent wall wakes. In the outer region, the velocity profiles were described by the (simple) wake equation, whereas in the inner (wall) region, the law of the wall applies. Using the similarity property of the velocity profiles, the integral momentum equation, and the experimental results generated from a wind-tunnel study, equations have been developed to predict the velocity and length scales. The wall shear stress was found to be approximately constant in a large part of the far-wake region. (Lee-ISWS)
W80-02187

FLOW FIELD AND SCOURING EFFECTS OF STEADY AND PULSATING JETS IMPINGING ON A MOVABLE BED,
Stuttgart Univ. (Germany, F.R.). Inst. fuer Wasserbau.
For primary bibliographic entry see Field 2J.
W80-02188

FLOW SEPARATION UNDER HYDRAULIC JUMP,
Toronto Univ., (Ontario). Dept. of Mechanical Engineering.
H. J. Leutheusser, and S. Alemu.
Journal of Hydraulic Research, Vol 17, No 3, p 193-206, 1979. 9 Fig, 2 Tab, 11 Ref.

Descriptors: *Hyraulic jump, *Laboratory tests, *Model studies, *Flow characteristics, Flow separation, Hydraulic models, Measurement, Flow, Hydraulics, Analysis, Transition flow, Undeveloped flow, Fully developed flow.

Experiments were described in which the occurrence of flow separation under hydraulic jumps was studied as a function of Froude number, Reynolds number, and condition of inflow. The investigation was carried out in the 11 m long and 0.6 m deep test section of a horizontal, 15 m long, and 0.4 m wide open-channel flume. The floor of the flume has a smooth enamel finish, and the side walls are composed of plate-glass panels. The flume is equipped with an adjustable tail gate located, respectively, upstream and downstream of the test section. It was found that separation occurs quite generally, that it extends beyond the conventional downstream end point of the hydraulic jump, and that its severity tends to increase with increasing Froude number and to decrease with increasing Reynolds number. In any case, however, the areal extent and thickness of the separation cavity is very much larger for jumps with undeveloped inflow than it is for their counterparts with fully developed inflow. (Humphreys-ISWS)
W80-02189

WAVE DIFFRACTION BY ABSORBING WEDGE,
Math-Tech Inst., Charlottenlund (Denmark).
For primary bibliographic entry see Field 2L.
W80-02335

WAVE FORCES ON PARTIALLY SUBMERGED CYLINDERS,
Salford Univ., (England). Dept. of Civil Engineering.
A. G. Dixon, C. A. Greated, and S. H. Salter.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 105, No WW4, Proceedings Paper 14996, p 421-438, November 1979. 11 Fig, 2 Tab, 21 Ref, 2 Append.

Descriptors: *Waves(Water), *Energy, *Loads(Forces), *Model studies, Mathematical models, Hydraulic models, Laboratory tests, Buoyancy, Pressure, Drag, Oceans, Ocean waves, Coastal engineering, Hydraulics, *Cylinders.

Morison's equation for wave force was adapted to predict the force exerted by regular waves on a partially submerged horizontal cylinder. In particular, the vertical force equation was modified by introducing a buoyancy term and a varying volume after first discarding the drag term. Some experimental data taken in a 30-cm wide tank were used to calculate a value of the inertial coefficient C sub M using a least squares fitting procedure. Although a spread was found in the values of C sub M, it was suggested that the theoretical value for a submerged cylinder, C sub M = 2, could be used with some success. (Sim-ISWS)
W80-02336

MIXING OF BUOYANT SURFACE JET OVER SLOPING BOTTOM,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-02338

TWO-DIMENSIONAL BUOYANT JETS IN STRATIFIED FLUID,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-02343

MULTIPLE JETS IN SHALLOW FLOWING RECEIVING WATERS,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-02344

8E. Rock Mechanics and Geology

EFFECTIVENESS OF VARIOUS SAND AND GRAVEL SEPARATES FOR DRAIN ENVELOPES,
California Univ., Davis. Water Science and Engineering Section.
For primary bibliographic entry see Field 8B.
W80-02076

GEOTHERMAL RESOURCES - WHAT TO LOOK FOR IN ARIZONA,
Arizona State Bureau of Geology and Mineral Technology.
N. O. Jones.
Fieldnotes, Vol 9, No 3, p 12-13, Sept, 1979. 4 Fig, 4 Ref.

Descriptors: *Geomorphology, *Geothermal studies, *Thermal properties, *Thermal water, Hydrogeology, Structural geology, Geologic formations, Geological surveys, Geochemistry, Geophysical factors, Arizona.

Over the past two years, the Arizona Bureau of Geology and Mineral Technology has conducted studies to establish the geological setting of the state's potential geothermal sites, and the surface, chemical, and geophysical characteristics indicative of Arizona's potential geothermal resources are reviewed here. The Bureau has determined from testing existing wells and drilling exploratory holes to ascertain volume/temperature that there are seven wells in Arizona with temperatures of over 100C. Although no electricity can be produced at these lower temperatures, several possible applications of this new source of energy are already being tried in Arizona including the drying of farm products and organic materials, evaporation in sugar refining, space heating, refrigeration, mushroom growing, soil warming, heating swimming pools, de-icing, the hatching of fish and others. The potential uses of geothermal resources are limited, it is concluded, only by the imagination of those who wish to put it to work. (Tickes-Arizona)
W80-02203

8I. Fisheries Engineering

PREFERRED STREAM DISCHARGES FOR SALMON SPAWNING AND REARING IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
C. H. Swift, III.
Geological Survey open-file report 77-422, 1979. 51 p, 14 Fig, 11 Tab, 6 Ref.

Descriptors: *Fish reproduction, *Salmon, *Spawning, *Washington, *Streams, Analytical

techniques, Streamflow, Flow rates, Drainage area, Channel morphology, Depth, Water levels, Equations, Fish migration, Fish populations.

Stream discharges preferred by salmon for spawning were determined from relationships between discharge and spawnable area at 84 study reaches on 28 streams in Washington. Preferred discharges for spawning were found statistically equivalent for chinook, pink, and chum salmon. Regression equations developed for estimating discharges preferred by these species for spawning at other stream sites had standard errors of estimate of 40 percent where a relationship with toe-of-bank channel width was used, and 55 percent where basin drainage area was used. Similarly, equations for estimating the preferred discharge for spawning by sockeye and coho salmon (also statistically equivalent) had standard errors of 48 percent using channel width and 61 percent using drainage area. In general, the discharges preferred for spawning by salmon ranged in magnitude from about 0.3 to 11 times the median monthly mean discharges for September and October and about 0.1 to 6 times the median monthly means for November and December--the four months when spawning is greatest. Stream discharges preferred by salmon for rearing were determined from relationships between discharge and wetted perimeter at the study reaches. Those discharges ranged from about 0.7 to 4 times the median monthly mean discharge for September, when low flows are usually most limiting on the rearing capacity of streams. Equations developed for estimating preferred rearing discharges at other stream sites had standard errors of 57 percent using channel width and 81 percent using drainage area. (Woodard-USGS).
W80-02243

OLFACTORY BULBAR ELECTRICAL RESPONSES OF RAINBOW TROUT (SALMO GAIRDNERI) EXPOSED TO MORPHOLINE DURING SMOLTIFICATION,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
T. J. Hara, and S. B. Brown.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1186-1190, 1979. 5 Fig, 25 Ref.

Descriptors: *Fish behavior, *Toxicity, *Organic compounds, Fish migration, Rainbow trout, Growth stages, Fish physiology, Chemical properties, Mode of action, Biochemistry, Water pollution effects, *Morpholine.

Exposure of rainbow trut to M.00005 mg/L) morpholine during smolting period did not influence the subsequent neural response to this substance, when tested immediately and 12 mo after smolting. No significant difference in the morpholine-induced responses was obtained between the exposed and unexposed fish. Using N-ethylmaleimide, a sulfhydryl reagent, it was further confirmed that the morpholine-effect is caused by a mechanism not directly associated with the normal olfactory function. Perfusion of the olfactory organs with 0.1M morpholine for 10 min irreversibly inhibited the olfactory responsiveness to odorants. Sensitization of the olfactory bulbar electrical response is discussed in connection with homing of morpholine-imprinted salmonid fishes. (Deal-EIS)
W80-02392

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

WATER-RESOURCES DATA INDEX FOR OSCEOLA NATIONAL FOREST, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
P. R. Seaber, and R. W. Hull.
Geological Survey open-file report 79-984, 1979. 42 p, 6 Fig, 9 Tab, 117 Ref.

Descriptors: *Hydrologic data, *Indexing, *Information retrieval, *Publications, Surface waters, Groundwater, Water quality, Phosphates, Mining, Climatic data, Meteorological data, Aquifers, Water levels, Test wells, Hydrogeology, Data storage and retrieval, Reviews, Florida, *Osceola National Forest(Fla).

The U.S. Geological Survey conducted an intensive investigation from December 1975 to December 1977 of the geohydrology of Osceola National Forest, Fla. The primary purpose was to provide the geohydrological understanding needed to predict the impact of potential phosphate industry operations in the forest on the natural hydrologic system. The investigation involved test drilling, implementation of a hydrologic monitoring network, water-quality sampling, comprehensive aquifer tests, and literature study. This report is an index to the type, source, location, and availability of the data used in the interpretive investigation. The indexes include: geological, geophysical, ground water, surface water, quality of water, meteorological, climatological, aquifer tests, maps, photographs, elevations, and reference publications. The manner of storage and retrieval of the data is decribed also. (Woodard-USGS).
W80-02240

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 7
APRIL 1, 1980

W80-02401 -- W80-02700
CODEN: SWRABW

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 7
APRIL 1, 1980

W80-02401 – W80-02700

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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01 NATURE OF WATER

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

TEMPERATURE IN STREAMS OF NEW MEXICO FOR THE PERIOD OCTOBER 1964 TO SEPTEMBER 1969,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. W. Clement.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 360, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-140, November 1978. 30 p, 7 Fig, 3 Tab, 22 Ref.

Descriptors: *Water temperature, *Streams, *New Mexico, Equations, Variability, Regression analysis, Regional analysis, *Harmonic equations, Areal description.

Harmonic equations were developed to describe stream temperatures at 144 sites in New Mexico using periodically observed water temperatures collected from October 1964 through September 1969. The harmonic equations explained at least 80 percent of the variability at 70 of the sites. Standard errors of estimate ranged from 1.3 to 5.4 degrees Celsius and averaged 3.1 degrees Celsius. Stream-temperature characteristics are defined in terms of the mean, amplitude, and phase coefficients of the harmonic equations. The characteristics vary widely throughout the State, hence are described areally by regionalized regression equations. Regional equations developed to describe the mean temperature characteristic accounted for at least 84 percent of the variability and had standard errors of estimate less than 13 percent. Only one equation was adequate for describing the amplitude. That equation was for streams having drainage areas less than 2,500 square miles and in the northwestern part of the State. No equation was developed for the phase coefficient. Stream-temperature characteristic profiles are used to describe the trends of the three characteristics along major streams. (Woodard-USGS)
W80-02580

DESIGN OF A NETWORK FOR MONITORING GROUND-WATER QUALITY IN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-02588

AN EPR STUDY OF THE REDUCTION OF VANADIUM(V) TO VANADIUM(IV) BY FULVIC ACID,
New Hampshire Univ. Durham. Dept. of Chemistry.
S. A. Wilson, and J. H. Weber.
Chemical Geology, Vol 26, p 345-354, 1979. 1 Fig, 1 Tab, 22 Ref. OWRT B-004-NH(1), 14-34-0001-8132.

Descriptors: *Fulvic acids, *Oxidation, *Humic acids, *Redox potential, *Oxidation-reduction potential, *Reduction potential, Ions, Hydrogen ion concentration, *Vanadium, *Metal ions, *Electron paramagnetic resonance, *Soil-derived fulvic acid, *Water-derived fulvic acid, Oxygenated water, Copper binding capacity, Electro-chemical oxidation.

The reduction potential of a soil-derived fulvic acid (SFA) sample is 0.5 V (vs. NHE). The SFA reduction potentials increase with decreasing pH which means tha H+ is consumed when SFA acts as an oxidizing agent. We used this SFA as a reducing agent toward vanadium (V) in an electron paramagnetic resonance (EPR) study. At pH 2 a 10-fold SFA molar excess reduces 50% of a vanadium (V) to a vanadium (IV) species (VO(+2)) within 15 min, but no additional reduction occurs within 4 h. The semiquinone radical in SFA is not involved in the reduction process because its EPR signal intensity does not decrease and because the amount of radical present could account for only 10% of the observed reduction. In a similar experiment at pH 6, only 4.5% soluble VO(+2) is measured by EPR. Most of the VO(+2) formed in the experiment forms EPR-inactive (VOOH)2(+2) and solid VP(OH)2. At pH 2.3 a solution of SFA and vanadium(V) in a 10/1 molar ratio has a reduction potential of 0.57 V (vs. NHE) in agreement with the reduction potential of SFA alone. EPR measurements show that the reduced vanadium product, VO(+2), is partially complexed to SFA at pH 2, but predominantly complexed at pH 4 and 6.
W80-02601

2. WATER CYCLE

2A. General

DETERMINING SOIL HYDROLOGIC CHARACTRISTICS ON A REMOTE FOREST WATERSHED BY CONTINUOUS MONTIORING OF SOILWATER PRESSURES, RAINFALL AND RUNOFF,
Hawaii Univ. at Manoa, Honolulu.
For primary bibliographic entry see Field 2G.
W80-02489

ON THE GENERALIZED KINEMATIC ROUTING METHOD,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W80-02577

USE OF A DIGITALIZED GRID IN THE MAPPING OF THE WATER BALANCE ELEMENTS IN A RIVER BASIN (UTILISATION D'UNE GRILLE D'ALTITUDES DIGITALISEES POUR LA CARTOGRAPHIE D'ELEMENTS DU BILAN HYDRIQUE),
Service Hydrologique National, Bern (Switzerland).
F. de Montmollin, R. Oliver, and F. Zwahlen.
Journal of Hydrology, Vol 44, No 3/4, p 191-209, December 1979. 5 Fig, 2 Tab, 12 Ref.

Descriptors: *Water balance, *Watersheds(Basins), *Analytical techniques, *Models studies, Precipitation(Atmospheric), Evaporation, Hydrology, Analysis, Mathematical models, Runoff, Foreign research, Mapping, Spatial distribution, *Switzerland, *Mentue River(Switzerland).

The authors tried to determine the various elements of the water balance in a Swiss middleland typical water basin. To obtain this result, they correlated pluviometry and elevation on a digitalized grid, which elements are 50 sq m. This allows the elaboration of coordinated maps of the kind as proposed by Nordenson. This requires the establishment of precipitation and evaporation maps (the Turc formula or any other can be used), and it also requires a knowledge of the runoff. To illustrate the possibilities of the models constructed, the authors studied the various characteristics of the Mentue, a river located north of Lausanne (Switzerland). (See also W69-05337) (Humphreys-ISWS)
W80-02675

APPLICATION OF A SNOWMELT-RUNOFF MODEL USING LANDSAT DATA,
National Areronautics and Space Administration, Greenblet, MD. Goddard Space Flight Center.
A. Rango, and J. Martinec.
Nordic Hydrology, Vol 10, No 4, p 225-238, 1979. 9 Fig, 19 Ref.

Descriptors: *Snow, *Runoff forecasting, *Wyoming, Model studies, Temperature, Precipitation(Atmospheric), Streamflow, Computers, Hydrology, Snow cover, Snowmelt, Data collections, *Snow-runoff model, LANDSAT.

The snowmelt-runoff model developed by Martinec has been used to simulate daily streamflow on the 228 sq km Dinwoody Creek basin in Wyoming, using snowcover extent from Landsat and conventionally measured temperature and precipitation. For the six-month snowmelt seasons of 1976 and 1974, the simulated seasonal runoff volumes were within 5 and 1%, respectively, of the measured runoff. Also, the daily fluctuations of discharge were simulated to a high degree by the model. Thus far the limiting basin size for applying the model has not been reached, and improvements can be expected if the hydrometeorological data can be obtained from a station inside the basin. Landsat provides an efficient way to obtain the critical snowcover input parameter required by the model. (See also W76-08131) (Lee-ISWS)
W80-02690

2B. Precipitation

AN INVESTIGATION OF POLLUTANT SOURCE STRENGTH-RAINFALL RELATIONSHIPS AT ST. LOUIS,
Illinois State Survey, Urbana. Atmospheric Sciences Section.
D. F. Gatz.
Journal of Applied Meteorology, Vol 18, No 10, p 1245-1251, October 1979. 7 Fig, 1 Tab, 12 Ref. DOE EY-76-S-02-1199.

Descriptors: *Air pollution, *Rainfall, *Correlation analysis, *Cities, Precipitation(Atmospheric), Pollutants, Path of pollutants, Sampling, Data collections, On-site investigations, Data processing, Analytical techniques, Meteorology, *St. Louis(MO).

Speculation concerning effects of pollutants on weather, especially rainfall, has intrigued scientists and laymen alike in recent years. Results from Project METROMEX suggest that rainfall is increased after a moving raincell intersects the urban plume. This paper investigated correlations between rainfall and indices of aerosol pollutant source strength to see whether a causative mechanism might be suggested. Although the correlations between rainfall in certain areas and the source strength of three groups of urban aerosols were significant enough to warrant further investigation, physical relationships did not support an aerosol involvement in the urban rainfall anomaly. (Sims-ISWS)
W80-02494

AN INVESTIGATION OF SURFACE ALBEDO VARIATIONS DURING THE RECENT SAHEL DROUGHT,
Wisconsin Univ., Madison. Space Science and Engineering.
For primary bibliographic entry see Field 7B.
W80-02497

MEASUREMENT OF CONVECTIVE MEAN RAINFALL OVER SMALL AREAS USING HIGH-DENSITY RAINGAGES AND RADAR,
Illinois State Water Survey, Urbana.
P. H. Hildebrand, N. Towery, and M. R. Snell.
Journal of Applied Meteorology, Vol 18, No 10, p 1316-1326, October 1979. 3 Fig, 7 Tab, 10 Ref. Bu.Rec. 14-06-D-7197,NSF ATM76-24236, ENV-01447.

Descriptors: *Rainfall, *Measurement, *Radar, *Rain gages, Analytical techniques, Data processing, Precipitation(Atmospheric), Networks, Rain, Remote sensing, Meteorology.

Techniques of measuring area-mean convective rainfall over small areas (less than 2000 sq km) were investigated using data from several gage-radar rainfall measurement studies. These data suggested that for low gage densities (less than 1 gage per 250-300 sq km) and for some climates (e.g., Illinois), gage-radar area-mean convective rainfall measurements may be more accurate than gage-only measurements. The same result was not supported by data from another climate, suggesting that changes in raincell size and rain evaporation rate may affect the results. Further studies are needed to verify these suggestions. The data indicated that radar adds little to gage measurement of mean areal convective rainfall for gage densities of more than 1 gage per 100-200 sq km. Use of a space-variable gage adjustment of radar data was

seen to be preferable to use of an averaged single adjustment factor, except in cases involving extrapolations of the space-variable adjustment factor. For such cases, e.g., over large lakes or outside of gage networks, use of the averaged single adjustment factor may be preferable. (Sims-ISWS)
W80-02530

ACID PRECIPITATION: MEASUREMENT OF PH AND ACIDITY,
Virginia Univ., Charlottesville, Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2K.
W80-02667

ACIDIFICATION AND OTHER CHEMICAL CHANGES IN HALIFAX COUNTY LAKES AFTER 21 YEARS,
Fisheries and Marine Service, Halifax (Nova Scotia).
For primary bibliographic entry see Field 2K.
W80-02668

USE OF A DIGITALIZED GRID IN THE MAPPING OF THE WATER BALANCE ELEMENTS IN A RIVER BASIN (UTILISATION D'UNE GRILLE D'ALTITUDES DIGITALISEES POUR LA CARTOGRAPHIE D'ELEMENTS DU BILAN HYDRIQUE),
Service Hydrologique National, Bern (Switzerland).
For primary bibliographic entry see Field 2A.
W80-02675

OBJECTIVE ANALYSIS OF CONVECTIVE SCALE RAINFALL USING GAGES AND RADAR,
Eddy (Amos), Inc., Norman, OK.
A. Eddy.
Journal of Hydrology, Vol 44, No 1/2, p 125-134, November 1979. 6 Fig, 16 Ref, 1 Append. BUREC 7-07-83-V007.

Descriptors: *Rainfall, *Rainfall disposition, *Mathematical models, *Analytical techniques, *Montana, Networks, Areal, Measurement, Rain gages, Radar, Temporal distribution, Spatial distribution, Storms, On-site investigations, Model studies, Statistical methods, Convective rainfall, Objective analysis.

A functional representation of the morphology and evolution of a mesoscale convective storm was illustrated using HIPLEX radar reflectivities and gage rainfall data observed in Montana. The use of this function in obtaining maximum likelihood estimates of storm-total rainfall and in the optimal deployment of the sensor network was also discussed. It was shown that after four gages per individual storm-total area have been deployed, the marginal benefit realized by adding one more gage is very small if the radar reflectivity data are combined optimally with observations from these gages to produce storm-total rainfall. It was shown that a method exists which allows for optimal sensor placement and an assessment of the relative values of competing network designs. Finally, it follows that if one makes a clear, statistically adequate statement of the central problem, the sampling and analysis procedures can be reduced to a problem in Bayesian decision making and can be expressed in terms of cost/benefit ratios for competing sampling strategies. (Humphreys-ISWS)
W80-02677

REAL-TIME ESTIMATION OF VELOCITY AND COVARIANCE STRUCTURE OF RAINFALL EVENTS USING TELEMETERED RAINGAGE DATA--A COMPARISON OF METHODS,
National Weather Service, Silver Spring, MD. Hydrologic Research Lab.
E. R. Johnson, and R. L. Bras.
Journal of Hydrology, Vol 44, No 1/2, p 97-123, November 1979. 6 Fig, 2 Tab, 12 Ref.

Descriptors: *Rainfall disposition, *Statistical models, *Analytical techniques, *Statistical methods, Rainfall intensity, Stochastic processes, Rainfall, Storms, Methodology, Velocity, Forecasting, Correlation analysis, Sampling, Tracking techniques, Time series analysis, Networks, Analysis, Regression analysis, Data processing.

Short-term rainfall prediction in time and space requires parameter estimation in real time. This paper discussed several methods of using telemetric raingage data to estimate the non-stationary mean and variance of a rainfall event. Similarly, real-time estimation of residual covariance structure and storm velocity was discussed. The performance of the suggested techniques was illustrated with examples. The parameter estimation corresponds to a forecasting model developed by Johnson and Bras. The goal of this article was to inform other researchers of the advantageous and desadvantages of different methodologies for reat-time estimation of ranifall statistical characteristics. The storm counter technique is easy to implenent in real time and is capable of representing significant features of a rainfall event. The method permits handling non-stationarities without major, inflexible, structural assumptions. Testing of several velocity estimators ranging from storm feature tracking to cavariance maximization clearly converged in a regression procedure based on time histories of raingages. The selected estimation procedure proved to be stable and convergent under many conditions. All the parameters estimated and discharged in this paper can be used in real-time forecasting of rainfall. (Humphreys-ISWS)
W80-02678

A DIGITAL RECORDING SYSTEM FOR TIPPING BUCKET RAINGAGES: DESCRIPTION AND FIELD TESTING,
National Hurricane and Experimental Meteorology Lab., Coral Gables, FL.
J. L. Thomas, and F. J. Merceret.
Journal of Applied Meteorology, Vol 18, No 10, p 1376-1379, October 1979. 2 Fig, 1 Tab, 2 Ref.

Descriptors: *Rain gages, *Equipment, *Instrumentation, *Electronic equipment, Design, On-site investigations, On-site data collections, Rainfall, Precipitation(Atmospheric), Measurement, Networks, Meteorology, Electrical engineering.

A system for recording data from a large network of tipping bucket raingages on digital tape cessettes was developed for the Florida Area Cumulus Experiment (FACE). This system is substantially less expensive than those previously available when large members of gages are needed. Field tests during June, July, and August 1978 in South Florida showed the system to be accurate and reliable. (Sims-ISWS)
W80-02680

DEPOSITION OF NUTRIENTS AND MAJOR IONS BY PRECIPITATION IN SOUTH-CENTRAL ONTARIO,
Ontario Ministry of the Environment, Rexdale (Ontario). Limnology and Toxicity Section.
For primary bibliographic entry see Field 2H.
W80-02685

SPATIAL CORRELATIONS OF PRECIPITATION IN NORTHWEST GEORGIA,
Oak Ridge National Lab., TN. Engineering Technology Div.
A. A. N. Patrinos, N. C. J. Chen, and R. L. Miller.
Report No ORNL/TM-6524, September 1978. 42 p, 21 Fig, 1 Tab, 15 Ref. No W-7405-eng-26.

Descriptors: *Precipitation(Atmospheric), *Georgia, *Correlation analysis, *Spatial distribution, Monthly, Topography, Climates, Winds, Distribution patterns, Weather modification, Variability, Analytical techniques, Analysis, Statistical methods, Least squares method, Spatial correlations, Correlation coefficients.

Spatial correlations based on monthly rainfall totals from northwest Georgia for the period 1949-1976 were studied. This work, a part of the Meteorological Effects of Thermal Energy Releases (METER) Program, determines natural variability rainfall trends and assists the field studies of potential precipitation effects of the Bowen Electric Generating Plant near Cartersville, Georgia. The spatial correlation coefficients were investigated with regard to distance between stations, wind direction, and topography. The results indicated a strong dependence of the calculated spatial correlation patterns on the direction of the prevailing storm tracks in the area. (Humphreys-ISWS)
W80-02698

2C. Snow, Ice, and Frost

THE MASS BUDGET OF THE LAMBERT GLACIER DRAINAGE BASIN ANTARCTICA,
Department of Science, Melbourne (Australia). Antarctic Div.
I. Allison.
Journal of Glaciology, Vol 22, No 87, p 223-235, 1979. 4 Fig, 5 Tab, 30 Ref.

Descriptors: *Glaciers, *On-site investigations, *Antarctic, *Drainage, Watersheds(Basins), Ice, On-site data collections, Movement, Geomorphology, Velocity, Measurement, Dimensions, Depth, Analysis, Melt water, Mass budget, Lambert Glacier.

Estimates have been made of the mass budget of the total drainage basin of Lambert Glacier. these show a small but significant positive state of balance for the interior basin (the accumulation area up-stream of the major ice streams), and strongly suggest a positive balance for the Lambert Glacier system (the region of major ice streams, between the Amery Ice Shelf and the interior basin). The total mass flux into the interior basin was estimated as 60 Gt/a. Results were presented from a number of ice movement stations established between 1972 and 1974 around the perimeter of the southern Prince Charles Mountains. These results, together with ice thicknesses from radio echo-sounding in the area, give a total mass outflux through the 2,000 m contour of 30 Gt/a, implying a budget excess of a further 30 Gt/a over the whole interior basin. Results from velocity and ice thickness measurements give a mass discharge through a section near the junction of Lambert Glacier and the Amery Ice Shelf of 11 Gt/a. Losses within the Lambert Glacier system proper account for a further 7 Gt/a and an overall mass excess of 12 Gt/a is estimated for the Lambert Glacier system. This present positive state of balance contrasts with geomorphological evidence from the southern Prince Charles Mountains of a large drop in ice level in recent geological time, and the ice surface in the area may now be building up after a major recession. (Humphreys-ISWS)
W80-02477

IN-SITU MEASUREMENTS OF THE ACTIVATION ENERGY FOR D.C. CONDUCTION IN POLAR ICE,
Wisconsin Univ., Middleton. Geophysical and Polar Research Center.
C. R. Bentley.
Journal of Glaciology, Vol 22, No 87, p 237-246, 1979. 9 Fig, 14 Ref.

Descriptors: *Ice, *On-site tests, *Electrical properties, *Activation energy, Temperature, Measurement, Resistivity, On-site investigations, Testing proceedures, Methodology, Analysis, Analytical techniques, Spatial distribution, *Ross Ice Shelf.

Electrical resistivity measurements were carried out at station J9 on the Ross Ice Shelf where temperature measurements were available to a depth exceeding three-quarters of the thickness of the shelf. As in a previously published study at a point about 30 km up-stream (Bentley, 1977), the apparent resistivities fit well to a model based upon a steady-state ice shelf with zero bottom balance-rate and an apparent activation energy in the solid ice of 0.15 to 0.25 eV, with preference for the lower end of the range. This model also fits the observed temperature data almost perfectly. Causes of resistivity variation with depth other than the temperature, such as impurtiy content, metamorphic hictory, grain size, and crystal orien-

tation, probably do not strongly affect th resistivity depth function. It was concluded that the true activation energy in the solid ice is less than 0.25 eV and perhaps as small as 0.15 eV, although a reduction by a factor of 2 or 3 in the ionic impurity concentration between 50 and 250 m depth cannot be entirely ruled out as a cause of the low apparent temperature effect. (See also W77-08051) (Humphreys-ISWS)
W80-02478

THE EFFECTS OF ICE THICKNESS ON THE EXCHANGE OF SOLAR RADIATION OVER THE POLAR OCEANS,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
T. C. Grenfell.
Journal of Glaciology, Vol 22, No 87, p 305-320, 1979. 9 Fig, 1 Tab, 20 Ref. ONR N00014-76-C-0234.

Descriptors: *Solar radiation, *Albedo, *Absorption, *Transmissivity, *Ice, *Snow, Snowpacks, Sea ice, Polar regions, Wavelengths, Radiation, Energy, Mass transfer, Heat, Temperature, Light, Irradiation, On-site data collections, Model studies, Mathematical models.

Total transmission, absorption, and reflection of solar radiation were determined for bare blue and white ice between 0.02 and 0.8 m in thickness as well as for blue ice covered with 0.01 to 0.4 m of dry packed snow. The calculations were performed at 45 wavelengths between 400 nm and 2,150 nm using a two-stream model to account for the finite thickness of the ice and snow layers. Total radiative energies were found by numerical integration over wavelength. The results were compared with corresponding calculations for optically thick ice of the same types. Albedos increase from about 0.05 for open water to a maximum of 0.9 for thick snow. For 0.8 m blue and white ice, predicted albedos on cloudy days are 0.28 and 0.67, respectively. Under clear skies these albedos decrease by 10 to 30%. Total transmission through thin ice (less than 0.8 m) is from 50% to 300% greater than is predicted by Beer's law depending on ice type and cloud cover. Radiative energy absorption at the surface is independent of thickness, but significant departures from Beer's law of as much as 200% are evident in all cases below a depth of 2.5 mm. A parameterization scheme was presented for incorporating these results into heat- and mass-balance studies. (Sims-ISWS)
W80-02479

IN-SITU ESTIMATES OF THE TENSILE STRENGTH OF SNOW UTILIZING LARGE SAMPLE SIZES,
Norwegian Geotechnical Inst., Oslo.
D. M. McClung.
Journal of Glaciology, Vol 22, No 87, p 321-329, 1979. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Snow, *Tensile strength, *On-site investigations, on-site data collections, Density, Strength, Shear strength, Temperature, Sampling, Data processing, Avalanches, Snowpacks, Mechanical properties.

Experimental procedure and measured estimates of the tensile strength of snow were given by a new method utilizing large sample sizes of naturally deposited snow. Data were presented as a function of average sample density, temperature, loading rate, and snow type. The results showed less scatter in the data than previous in-situ estimates and lower mean strength values as a function of density. The relevance of the data to tensile fracture as observed in slab avalanche release was discussed. (Sims-ISWS)
W80-02480

COMPOSITION, INTERNAL STRUCTURES, AND AN HYPOTHESIS OF FORMATION FOR DRUMLINS, WAUKESHA COUNTY, WISCONSIN, U.S.A.,
Wisconsin Univ.- Madison. Dept. of Geology and Geophysics.
G. R. Whittecar, and D. M. Mickelson.
Journal of Glaciology, Vol 22, No 87, p 357-371, 1979. 8 Fig, 32 Ref.

Descriptors: *Glacial drift, *Wisconsin, *Glaciology, *Geomorphology, Till, On-site investigations, Analysis, Erosion, Maps, Stratigraphy, Land forming, Topography, Gravels, Sands, Shape, Drumlins, Clastic dike.

Late Wisconsin-age drumlins west of Milwaukee are clustered atop uplands bounded by discrete scarps. Gravel operations within the uplands have exposed drumlin cores of undeformed till and outwash beds which are truncated at the sides of the drumlin. In a few areas, clastic dikes, faults, overturned bedding, and shear folds disturb the original layering. The drumlin shapes are blanketed with a basal till 1-3 m thick ('retreat' till) which truncates all internal structures. This till covering cannot be distinguished from the youngest truncated till ('advance' till). Truncation of all of these structures shows that these drumlins are erosional forms carved from pre-existing drift. Apparently, during erosion under compressive flow, some beds became unstable and initiated large-scale movements of material into the drumlin from beneath the drumlin form. Failure and mobilization of the finer grained beds may have been due to increased pore pressures, differing stages of dilatancy, or diff ering bulk densities. A growth into the drumlin from below and rates of erosion of the drumlin form. (Humphreys-ISWS)
W80-02481

THE MECHANICS OF DRUMLIN FORMATION WITH PARTICULAR REFERENCE TO THE CHANGE IN PORE-WATER CONTENT OF THE TILL,
Brock Univ., St. Catharines (Ontario). Dept. of Geography.
J. Menzies.
Journal of Glaciology, Vol 22, No 87, p 373-384, 1979. 6 Fig, 52 Ref.

Descriptors: *Glacial drift, *Pore water, *Glaciology, *Geophysics, Land forming, On-site investigations, Magnetic studies, Till, Topography, Erosion, Ice, Rheology, Geomorphology, Stratigraphy, Analysis, Gravels, Sands, *Scotland, Drumlins.

Most drumlins are composed of till that appears similar in all characteristics to non-drumlin till. Evidence, however, in the form of till layer sequences and from palaeo-magnetic Koenigsberger ratios indicate that drumlin till may have a slightly higher pore-water content at the time of lodgement than non-drumlin till. In order that deposited till remains at the ice-glacier-bed interface to initiate drumlin formation, it must undergo rapid geotechnical changes whereby its pore-water content is dissipated thereby increasing the shear strength of the till. Two mechanisms of pore-water removal are possible. First, pore water may be removed from localized patches within a mobile layer of till at the ice-glacier-bed interface, thus creating nuclei of higher strength till around which deforming till may adhere. Second, removal of water initially from the thin water film at the base of a glacier may result in increased pressure melting of the ice leading to till melt-out and subsequent loss of pore water from the deposited till. The loss of water at the glacier bed may be either via permeable subglacial deposits or bedrock, or bedrock, or within subglacial depressions. (Humphreys-ISWS)
W80-02482

MERCURY-IN-GLASS THERMOMETERS FOR PRECISE TEMPERATURE MEASUREMENTS NEAR O C,
Alaska Univ., Faribanks. Geophysical Inst.
T. E. Osterkamp.
Journal of Glaciology, Vol 22, No 87, p 385-388, 1979. 1 Fig, 1 Tab, 3 Ref. NSF GA-30748.

Descriptors: *Thermometers, *Temperature, *Measurement, *Equipment, Instrumentation, Calibrations, Laboratory tests, On-site investigations, On-site data collections, Glaciers, Ice, Snow, Glaciology.

Experience with the calibration and field use of mercury-in-glass calorimeter thermometers provided an indication of the accuracy attainable and the necessary corrections to obtain that accuracy. Secular changes as large as 57 mK were observed during the first three years of thermometer use. Light physical tapping was found to reduce the thermometer readings by 3-6 mK. Corrections for variations in the external and internal bulb pressure and care to avoid parallax were necessary to obtain the best accuracy in field measurements. The best accuracy obtainable with these thermometers for temperature measurements near O C was approximately plus or minus 4 mK for laboratory measurements and plus or minus 5 mK for field measurements. (Sims-ISWS)
W80-02483

A SYSTEM FOR ACCURATE TEMPERATURE CONTROL OF SMALL FLUID BATHS,
Department of Science, Melbourne (Australia). Antarctic Div.
V. I. Morgan.
Journal of Glaciology, Vol 22, No 87, p 389-391, 1979. 2 Fig, 2 Ref.

Descriptors: *Temperature, *Temperature control, *Equipment, *Instrumentation, Ice, Laboratory tests, Electronic equipment, Heat, Heating, Control, Laboratory equipment.

A temperature controller was described which uses a thermistor sensor and electrical heating to maintain the temperature of a small bath of fluid to within a few milli-degrees. (Sims-ISWS)
W80-02484

THE FLOW OF ICE OVER A TILL BED,
Queensland Univ., Brisbane (Australia). Dept. of Mathematics.
A. S. Jones.
Journal of Glaciology, Vol 22, No 87, p 393-395, 1979. 2 Fig, 3 Ref.

Descriptors: *Glaciers, *Ice, *Model studies, Mathematical models, Equations, Till, Soils, Glacial soils, Glaciology, Glacier surging.

This paper considered the contribution made to overall glacier flow by deformation of an unlithified bed. The flow pattern in deforming till beneath a glacier was determined for the case of a uniform ice slab resting on a uniform thick till bed. The results obtained showed that, once the till is saturated, very little surplus water is needed to produce high velocities in the till near the ice-till interface, the interface velocity varying as the 5/2 power of the surplus water concentration. This sensitivity to water content suggests that this may be a mechanism inducing glacier surging. (Sims-ISWS)
W80-02485

PATTERN RECOGNITION ANALYSIS OF SNOWDRIFTS,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
W. J. Rawls, and T. J. Jackson.
Nordic Hydrology, Vol 10, No 4, p 251-260, 1979. 4 Fig, 2 Tab, 22 Ref.

Descriptors: *Snowpacks, *Demonstration watersheds, *Idaho, *Distribution patterns, Snow cover, Watersheds(Basins), Spatial distribution, Snow management, Snow surveys, Remote sensing, Aerial photography, On-site investigations, Methodology, Analytical techniques, Analysis, Topography, *Owyhee Mountains(ID).

Terrain features and prevailing wind patterns play a dominant role in how snow is accumulated. Research was conducted to determine the location of snowdrifts on a 0.41 sq km subbasin of the Reynolds Creek Experimental Watershed located in the Owyhee Mountains in southwestern Idaho. Snow depths at maximum accumulation were determined on a 7.6 m grid using aerial photography. The terrain variables used in the analysis were ground slope, ground aspect, elevation, distance from the top of the ridge in the direction of the

prevailing wind, and the difference in elevation between the top of the ridge and the point. A pattern recognition technique called cluster analysis was used to determine the best terrain variables for locating snowdrifts. The analysis indicated that slope and aspect were the best variables. Discriminant functions using these variables and the prevailing wind were developed to predict the location of snowdrifts. The functions were tested on a 16.7 sq km area and satisfactorily predicted the location of snowdrifts. Such relationships for predicting the location in snow drifts will enable better management of the vast amounts of water stored in snow drifts which is needed in making management decisions for irrigation, stock water, municipal water supplies, hydroelectric power generation, recreation, navigation, and pollution control. (Humphreys-ISWS)
W80-02688

APPLICATION OF A SNOWMELT-RUNOFF MODEL USING LANDSAT DATA,
National Areronautics and Space Administration, Greenblet, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2A.
W80-02690

2D. Evaporation and Transpiration

USE OF A DIGITALIZED GRID IN THE MAPPING OF THE WATER BALANCE ELEMENTS IN A RIVER BASIN (UTILISATION D'UNE GRILLE D'ALTITUDES DIGITALISEES POUR LA CARTOGRAPHIE D'ELEMENTS DU BILAN HYDRIQUE),
Service Hydrologique National, Bern (Switzerland).
For primary bibliographic entry see Field 2A.
W80-02675

A COMPARISON OF SOME METHODS FOR ESTIMATION OF POTENTIAL EVAPORATION,
Royal Veterinary and Agricultural Coll. Copenhagen (Denmark). Hydrotechnical Lab.
K. J. Kristensen.
Nordic Hydrology, Vol 10, No 4, p 239-250, 1979. 10 Fig, 1 Tab, 16 Ref.

Descriptors: *Evaporation, *On-site tests, *Evapotranspiration, *On-site data collections, On-site investigations, Instrumentation, Evaporative pans, Measurement, Evaporimeters, Water loss, Grasses, Barley, Sugar beets, Foreign research, *Denmark, Winter wheat.

In Denamrk, a screened sunk iron pan has been used as a standard since 1956. This standard pan and other methods for estimating potential evaporation have been compared during a 15-year period. The measurements reported were carried out at the Climate and Water Balance Station of the Royal Veterinary and Agricultural University, Denmark. The station is situated about 20 km west of Copenhagen. The installations are placed in or above a level area covered by short grass. The area was irrigated whenever needed in order to avoid or to reduce oasis effect caused by insufficient evaporation from areas surrounding the climate station. The results presented indicate that under climatic conditions as in Denmark, the potential evaporative demand of a vegetation can be estimated reasonably well by sunk iron pans or by the Penman calculating method. The sunk pan evaporation is proportional to maximum crop evaporation and to the calculated evaporation, provided the thermal convection of the water in the tank is prevented and that a screen, when used, is not impeding the ventilation of the water surface. The maximum evaporation from a free water surface (12 sq m) is about 10% greater than the potential evaporation from grass. The maximum actual evapotranspiration from some agricultural crops (e.g., barley and sugar beets) exceeds the potential evapotranspiration from grass by about 10%. (Humphreys-ISWS)
W80-02689

COMPARISON AND COMBINATION OF TWO RECENT PROPOSALS FOR A GENERALIZED PENMAN EQUATION,
Dar es Salaam Univ., Tanzania. Dept. of Physics.
C. J. Stigter.
Quarterly Journal of the Royal Meteorological Society, Vol 105, No 446, p 1071-1073, October 1979. 1 Tab, 8 Ref.

Descriptors: *Evaporation, *Equations, *Agricultural runoff, Hydrologic data, Hydrology, Water management(Applied), Calibrations, Lysimeters, Vegetation, Wind velocity, Roughness(Hydraulic), *Penman equation, *Agricultural water management, Hydrological water management, Aerodynamical terms, Grass lysimetry, Average wind speed.

The importance of Penman's evaporation equation in agricultural and hydrological water management was shown by two proposals for its generalization. The 1977 proposal, based on experimental work done in 1977 and on the theoretical study by Thom and Oliver in 1977, suggests that the experimental studies and the theoretical work be combined in order to generalize the equation in the interests of greater physical realism and higher accuracy. In both cases the calibration problem remained. The experimental study used only lysimeter experiments and crop coefficients based on field studies of soil and water status. The theoretical study relied on catchment area water balance studies to contribute to the solution of evaporation. (See also W77-09953) (Roberts-ISWS)
W80-02699

2E. Streamflow and Runoff

DETERMINING SOIL HYDROLOGIC CHARACTRISTICS ON A REMOTE FOREST WATERSHED BY CONTINUOUS MONTIORING OF SOILWATER PRESSURES, RAINFALL AND RUNOFF,
Hawaii Univ. at Manoa, Honolulu.
For primary bibliographic entry see Field 2G.
W80-02489

SECONDARY FLOW AND SHEAR STRESS AT RIVER BENDS,
Institute of Hydrology, Wallingford (England).
J. C. Bathurst, C. R. Thorne, and R. D. Hey.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY10, Proceedings Paper 14906, p 1277-1295, October 1979. 9 Fig, 3 Tab, 42 Ref, 1 Append.

Descriptors: *Shear stress, *River beds, *Rivers, Hydraulics, Bank stability, Velocity, Currents(Water), Turbulence, Circulation, Open channel flow, Curves, On-site investigations, *Secondary flow, *Velocity distributions, *River bends, *Curvature.

Field measurements were presented to illustrate the pattern of secondary circulation at river bends, the effect of the circulation on boundary shear stress distribution, and the way in which that effect changes with discharge. The field results showed that, in addition to the classical main cell, there can be a small cell of opposite circulation close to the outer bank provided the bank is steep. The circulation distorts the primary isovel pattern and thereby affects the positions and relative magnitudes of the boundary shear stress peaks associated with regions of downwelling and high velocity. Secondary circulation appears to be weakest at low and high discharges and to be strongest, with its greatest effect on the shear stress distribution, at medium discharges. Generally, the distribution of shear stress at a section becomes more uniform as discharge increases and at high discharges is determined mainly by primary flow effects. (Adams-ISWS)
W80-02566

ON THE GENERALIZED KINEMATIC ROUTING METHOD,
Institute of Hydrology, Wallingford (England).
K. Beven.
Water Resources Research, Vol 15, No 5, p 1238-1242, October 1979. 5 Fig, 8 Ref.

Descriptors: *Rainfall-runoff relationships, *Routing, *Small watersheds, Hydrology, Runoff, Model studies, Velocity, Discharge(Water), Channels, Flow, Watersheds(Basins), *England, *Kinematic routing method, Steep rough upland channels, Channel networks, Small upland watersheds.

Field measurements suggest that the relationship between velocity and discharge in steep rough upland channels may be nonlinear at low-flow stages but approximately linear at high-flow stages. This paper described a generalized kinematic channel network routing model which can allow a flow relationship that describes both high- and low-flow characteristics. The model was applied to the channel network of the Institute of Hydrology's River Severn experimental catchment and, for this specific application, proved to be equivalent to a linear model based on a constant kinematic flow velocity. A strategy for choosing and applying a flow routing model for use in small catchments was suggested. (Lee-ISWS)
W80-02577

FLOW ROUTING IN THE SUSQUEHANNA RIVER BASIN: PART III - ROUTING RESERVOIR RELEASES IN THE TIOGA AND CHEMUNG RIVERS SYSTEM, PENNSYLVANIA AND NEW YORK,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-02586

RANGE OF INDEPENDENT MIXTURE MODELS IN HYDROLOGY,
Technical Univ. of Istanbul (Turkey), Dept. of Hydraulics and Water Power.
Z. Sen.
Water Resources Research, Vol 15, No 5, p 1213-1216, October 1979. 6 Fig, 12 Ref.

Descriptors: *Model studies, *Hydrology, *Stochastic processes, Droughts, Reservoirs, Statistical models, Equations, Effects, *Independent mixture models, Inflow sequence.

A general formula relating low order statistics of surplus and deficit to range of cumulative departures was proposed on the basis of the independent mixture models. By means of derived expressions, the effects of both drought duration and intensity on the range were documented, leading to the conclusion that even if the successive observations are independent, increases in drought duration and intensity cause the range to increase. (Lee-ISWS)
W80-02587

MATHEMATICAL DERIVATION OF LINEAR AND NONLINEAR RUNOFF KERNELS,
Tokyo Inst. of Tech. (Japan), Dept. of Civil Engineering.
M. Hino, and K Nadaoka.
Water Resources Research, Vol 15, No 4, p 918-928, August 1979. 11 Fig, 18 Ref.

Descriptors: *Unit hydrographs, *Mathematical models, *Analytical techniques, Parametric hydrology, Synthetic hydrology, Simulation analysis, Mathematics, Rainfall-runoff relationships, Model studies, *Runoff kernels, Basin response, Nonlinear kernels.

From a viewpoint of overall grasp of response characteristics of a basin to rainfall, an integral form of expression, such as the unit hydrograph, the Volterra series, and the Wiener series, is superior to differential equation type expressions. However, hitherto, response or runoff kernels have been derived from empirical data or at the most from numerical simulation data. In this paper, the runoff was represented by the Wiener-Hermite orthogonal functional expansion. By application of the Galerkin technique, a set of ordinary nonlinear differential equations for the expansion coefficients of kernal functions was derived from the basic equation of motion. The differential equations were solved by the Runge-Kutta-Gill scheme to obtain

the runoff kernels. Various features of the theoretical linear and nonlinear runoff kernels thus derived compared well with the empirical ones. The characteristics such as small humps and shallow ditches in the nonlinear kernel derived previously from empirical data were shown to be neither insignificant errors inherent in field data nor interactions between the components other than surface runoff but were a theoretical necessity. (Singh-ISWS)
W80-02655

CRITICAL EXAMINATION OF THE MUSKINGUM METHOD,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Civil Engineering.
M. A. Gill.
Nordic Hydrology, Vol 10, No 4, p 261-270, 1979. 2 Fig, 12 Ref.

Descriptors: *Flood routing, *Hydrology, *Rivers, Channels, Time lag, River beds, Equations, Mathematical studies, Waves(Water), Discharge(Water), Inflow, Kinematic wave approach, Kinematic wave analogy.

The Muskingum method of flood routing was critically reviewed. The kinematic wave approach was used to evaluate the Muskingum parameters. The linear hydrological method of using the Muskingum equation leads to conclusions which are comparable with those deducible from the linear kinematic wave theory. The linear kinematic approach, however, is somewhat delimited in its scope, because for $X = 0.5$, it always predicts a translatory wave, which may not actually be the case. The hydrological method is free from this fault. The concept of time lag was emphasized, particularly for initial values of time. Conventionally, it was assumed that the inflow and outflow hydrographs start changing from initial steady flow condition simultaneously. It was emphasized that this fact is not always the case. The outflow hydrograph will only start changing after the lapse of a certain time from the moment when the inflow hydrograph starts changing. The use of the time lag concept eliminated the initial appreciably reduced or sometimes even negative values of the routed outflow hydrograph. (Lee-ISWS)
W80-02687

APPLICATION OF A SNOWMELT-RUNOFF MODEL USING LANDSAT DATA,
National Areronautics and Space Administration, Greenblet, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2A.
W80-02690

SWMM APPLICATION TO COMBINED SEWERAGE IN NEW HAVEN,
Cardinal Engineering Associates, Meriden, CT.
J. A. Cermola, S. DeCarli, D. R. Sachdev, and H. M. El-Baroudi.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE6, Proceedings Paper 15042, p 1035-1048, December 1979. 6 Fig, 6 Tab, 9 Ref, 1 Append.

Descriptors: *Storm runoff, *Urban runoff, *Combined sewers, *Model studies, Mathematical models, Computer models, Calibrations, Runoff, Sewers, Drainage, Precipitation(Atmospheric), Rainfall, Srorms, Design storms, Watersheds(Basins), Pollutants, Water pollution, Overflow, Water quality, Biochemical oxygen demand, Suspended solids, Water management(Applied), *New Haven(CT).

Storm Water management Model (SWMM) of EPA was calibrated to predict runoff flows in the central portion of the city of New Haven, Connecticut. The study area is served by combined sewers and overflow structures to divert excess wet weather flow into the adjacent receiving waters. For application of SWMM, the project area was divided into 23 subcatchments, and two of them were selected for model calibration. During storm events, the rainfall hyetographs, the runoff hydrographs, and combined sewage quality parameters were measured in each of the two subcatchments. Using these data in SWMM, calibration and verification of flow quantities were accomplished successfully. However, problems were encountered in the quality calibration. The calibrated model (quantity portion only) was subsequently used to predict runoff flows for the design storm in each of the 23 subcatchments. A two-year storm was selected as design storm from the available 35 years of rainfall record. Literature values of BOD and SS were used to predict wet weather waste loads. (Sims-ISWS)
W80-02694

CALCULATION OF STRONGLY CURVED OPEN CHANNEL FLOW,
Karlsruhe Univ. (Germany, F.R.).
M. A. Leschziner, and W. Rodi.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY10, Proceedings Paper 14927, p 1297-1314, October 1979. 8 Fig, 21 Ref, 2 Append.

Descriptors: *Turbulence, *Open channel flow, *Hydraulics, Velocity, Currents(Water), Shear stress, Circulation, Mathematical models, Curves, Model studies, *Secondary flow, *Velocity distributions, *River bends, *Finite difference analysis, Curvature.

The paper described the application of a finite-difference calculation procedure to the problem of simulating the three-dimensional, turbulent flow in a strongly curved, open, 180 deg bend with straight inlet and outlet reaches. The configuration can be considered to represent an element of a model meander, and the work presented here forms an important stage in efforts to simulate the flow in successive reverse-curvature bends. No restrictions other than the absence of flow separation and hydraulic jumps are imposed. Full account was taken of non-linear fluid-inertia and of turbulent diffusion terms. Effects of turbulence were represented by an eddy viscosity related to two parameters--the turbulent kinetic energy and its rate of dissipation--for which related differential transport equations were solved. Predictions were presented for the transverse surface slope and velocity field in a configuration experimentally examined by Rozovskii. Agreement between predictions and experimental data was judged to be satisfactory on all major flow phenomena. (Adams-ISWS)
W80-02696

2F. Groundwater

THE EFFECT OF HYDROGEOLOGY ON VARIATIONS IN THE ELECTRICAL CONDUCTIVITY OF GROUNDWATER FLUCTUATIONS,
Andhra Univ., Waltair (India). Dept. of Geophysics.
V. V. J. Sarma, N. V. B. S. S. Prasad, and P. R. Prasad.
Journal of Hydrology, Vol 44, No 1/2, p 81-87, November 1979. 4 Fig, 1 Tab, 6 Ref.

Descriptors: *Hydrogeology, *Groundwater, *Water level fluctuations, *Electrical conductance, *Fissures(Geologic), Geologic control, Conductivity, Sampling, Water wells, Dissolved solids, Ion exchange, Weathering, Water table, Clays, *India.

A regular monthly inventory of water level height and water quality of about 100 wells along the coast from Visakhapatnam to Bhimilipatnam was made for a 13-month period during 1974-1975. The electrical conductivity of the waters was found to vary with seasonal water level fluctuations. However, it was observed that this variation has two different patterns. The first pattern is that when the water level lowers, the electrical conductivity decreases; and the second pattern is that when the water level lowers, the electrical conductivity increases. The geological environment is the same for both cases, but the two patterns result from water table fluctuations in two different hydrogeological zones. (Visocky-ISWS)
W80-02412

FRACTURE-CONTROLLED GROUND-WATER CIRCULATION AND WELL SITING IN THE VICINITY OF LARAMIE, WYOMING,
Wyoming Univ., Laramie. Dept. of Geology.
P. W. Huntoon, and D. A. Lundy.
Ground Water, Vol 17, No 5, p 463-469, September-October 1979. 5 Fig, 2 Tab, 15 Ref. OWRT A-024-WYO(2), OWRT 14-34-0001-7108.

Descriptors: *Groundwater, *Aquifers, *Wyoming, Groundwater movement, Artesian aquifers, Wells, Sites, Water wells, Fractures(Geologic), Fracture permeability, Transmissivity, Geology, Springs, Limestones, Circulation, Water circulation, Water quality, Water resources.

The artesian Casper aquifer, comprised of 700 ft of interbedded limestones and sandstones, currently supplies 70% (3.5 Mgal/d) of the municipal-water needs of Laramie, Wyoming. Large transmissivities occur in fracture zones associated with faults and folds in the area, and water discharges from several springs localized along these structures. Transmissivities in fracture zones are 100 times greater than those in unfractured parts of the aquifer. The overlying Satanka Shale is a regional confining unit even in most areas of fracturing, and is a source of poor quality groundwater. Prospecting for new groundwater supplies near Laramie involves mapping the tectonic structures and drilling into them once they are identified. (Sims-ISWS)
W80-02414

AVAILABILITY OF GROUND WATER ON FEDERAL LAND NEAR THE AK-CHIN INDIAN RESERVATION ARIZONA--A RECONNAISSANCE STUDY,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-02581

MAPS SHOWING GROUND-WATER CONDITIONS IN THE KANAB AREA, COCONINO AND MOHAVE COUNTIES, ARIZONA--1976,
Geological survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-02589

SELECTED WELL INVENTORY AND CHEMICAL ANALYSIS OF GROUND WATER, PARTS OF MISSOULA AND POWELL COUNTIES, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
K. R. Wilke.
Availability: OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, microfiche $5.50, paper copy $3.25. Geological Survey open-file report 79-1491, September 1979. 4 p, 2 Fig, 2 Tab.

Descriptors: *Water wells, *Well data, *Water levels, *Water quality, *Groundwater, Chemical analysis, Water utilization, Montana, *Well inventory, *Missoula County(MT), *Powell County(MT).

Ground-water data collected in 1975-76 in the Swan and Avon valleys of western Montana and in 1978 in southwestern Missoula are presented in two tables. Table 1 is an inventory of 146 selected wells and table 2 lists chemical analyses of ground water from 52 wells. (Woodard-USGS)
W80-02590

AN IMPROVED MONTE CARLO PROCEDURE FOR THE SOLUTION OF THE STEADY-STATE, TWO-DIMENSIONAL DIFFUSION EQUATION WITH APPLICATION TO FLOW THROUGH POROUS MEDIA,
Kansas Univ., Lawrence. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 6A.
W80-02607

HYDROGEOLOGY OF SEDIMENTARY ROCKS: PART I - CARBONATES,

Geo-Environ, Ltd., Toronto (Ontario).
B. Whitehead.
Canadian Water Well, Vol 5, No 4, p 26-29, November, 1979. 4 Fig.

Descriptors: *Karst hydrology, *Carbonate rocks, Sedimentary rocks, Limestones, Dolmite, Groundwater, Aquifer characteristics, Deposition, Porosity, Water yield, Fracture permeability, Hydrogeology.

Shale, carbonates, and sandstone are the sedimentary rocks that are important sources of groundwater. The Hydrogeologic characteristics of these rocks are affected by texture, mineral composition and pre-and post-depositional environments. The main carbonate sediments are limestone and dolomite. Compaction reduces porosity to less than 20%. Dolomitization may increase porosity by as much as 13%. Surface weathering of carbonate rock results in solutioning along fractures which permits the development of substantial quantities of water in the upper 10 ft. of rock. However, care should be taken to prevent the entrance of wastes into the ground water through solution channels. Water levels in carbonate aquifers can fluctuate considerably which may have a drastic effect on well yield. Well yield can be improved by development techniques such as controlled blasting, hydraulic fracturing, and acidizing. (Purdin-NWWA)
W80-02661

GROUNDWATER QUALITY NEAR AN UNDERGROUND COAL GASIFICATION EXPERIMENT,
California Univ., Livermore. Lawrence Livermore Lab.
J. H. Campbell, F. T. Wang, S. W. Mead, and J. F. Busby.
Journal of hydrology, Vol 44, No 3/4, p 241-266, December 1979. 13 Fig, 8 Tab, 15 Ref.

Descriptors: *Groundwater, *Water quality, *Coal mines, *Gases, *Wyoming, Sampling, Wells, Organic matter, Phenols, Wastes, Water pollution, On-site investigations, Methane, Electrical conductance, Coal gasification.

Groundwater sampling and analysis have been carried out at the site of an underground coal gasification experiment conducted near Gillette, Wyoming. Water from more than 12 wells in the vicinity of the experiment was sampled before, during, and up to 25 months following gasification. Water samples were analyzed for a variety of characteristics, including the presence of 70 inorganic species, phenolic materials, and volatile and semi-volatile organics. A greatly increased concentration of organic materials, particularly phenols, just outside the burn boundary and a variety of inorganic species issuing from within the residual ash bed were found. All detectable contaminants rapidly decreased in concentration with distance, although above-background levels of some materials were detected 30 m from the burn zone within three days of the gasification. Several important contaminants showed a large decrease in concentration with time, probably due to adsorption. The results suggested a simple physical picture of the development of groundwater pollution near an underground coal gasifier. (Visocky-ISWS)
W80-02674

THE TRANSIENT WATER TABLE BENEATH A LEAKING CANAL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
D. E. Smiles, and J. H. Knight.
Journal of Hydrology, Vol 44, No 1/2, p 149-162, November 1979. 6 Fig, 1 Tab, 18 Ref.

Descriptors: *Groundwater, *Infiltration, *Unsteady flow, *Analytical techniques, Water table, Porous media, Fluid mechanics, Hydrodynamics, Model studies, Leakage, Equations, Differential equatons, Leaky canals.

An approximate but accurate analysis of the evolution of the groundwater table beneath a leaking irrigation canal was described. The analysis treated the canal as a constant-rate line source and used the notion of the flux-concentration relation of Philip. The method was not restricted to initially dry aquifers. Extension of the analysis to layered soils was discussed. (Adams-ISWS)
W80-02676

HYDROGEOCHEMISTRY OF THE CORSAGLIA VALLEY, MARITIME ALPS, PIEDMONT, ITALY,
Turin Univ (Italy). Ist. di Geologia e Paleontologia.
G. C. Bortolami, B. Ricci, G. F. Susella, and G. M. Zuppi.
Journal of Hydrology, Vol 44, No 1/2, p 57-59, November 1979. 12 Fig, 3 Tab, 15 Ref.

Descriptors: *Geochemistry, *Hydrogeology, *Karst hydrology, *Crystalline rocks, *Fracture permeability, Carbonate rocks, Groundwater movement, Base flow, Geologic control, Water chemistry, Limestones, Flow system, Permeability, Watersheds(Basins), Rain water, Valleys, Sampling, Deuterium, Oxygen isotopes, Precipitation(Atmospheric), Chlorides, Sulfates, *Italy, *Alps.

This study presented the results of hydrogeochemical investigations in the drainage basin of the Corsaglia Valley (Piedmont, Italy). This small catchment area (110 sq km) is located on the northern side of the Maritime Alps and shows different lithologic types (crystalline and carbonate rocks). It is possible to find zones with important karstic systems adjacent to very impermeable rocks in which local groundwater flow can occur through fracture systems. Because of the complex geology, all karstic systems and their respective catchment areas are independent. Thirty-six sampling stations were selected throughout the basin, and sampling was carried out during two different climatic periods: during April 1976 and October 1974. The problems considered in this investigation were: (1) chemical compositons of rain waters as a function of geographic locations and climatic conditions; (2) crystalline rock hydro-geochemistry; (3) rock-water interactions in karstic systems; and (4) water flow in carbonate rocks and related fluctuations of chemical contents. Two principal flow systems can be recognized for the karst: the first, deep and chemically homogeneous, represents the base flow; the second, shallow and characterized by rapid flow, has a low and variable salt content. In the crystalline rocks only one flow system can be recognized: it is characterized by rapid flow and a remarkable variation of the ionic species. (Visocky-ISWS)
W80-02679

2G. Water In Soils

DETERMINING SOIL HYDROLOGIC CHARACTRISTICS ON A REMOTE FOREST WATERSHED BY CONTINUOUS MONTIORING OF SOILWATER PRESSURES, RAINFALL AND RUNOFF,
Hawaii Univ. at Manoa, Honolulu.
L. R. Ahuja, and S. A. El-Swaify.
Journal of Hydrology, Vol 44, No 1/2, p 135-147, November 1979. 10 Fig, 1 Tab, 10 Ref.

Descriptors: *Rainfall-runoff relationships, *Hawaii, *Watersheds(Basins), *Forest watersheds, Forestry, Soil-water-plant relationships, Rainfall, Runoff, Hydrology, Hydraulic conductivities, *Soil-water pressures, Soil hydrologic charactristics, Richard's equation.

Continuous monitoring of soil water pressures, rainfall, and runoff under natural conditions was tested as a technique for determinig soil hydrologic characteristics of a remote forest watershed plot. A completely battery-powered (and thus portable) pressure transducer-scanner-recorder system was assembled for monitoring of soil water pressures in the tensiometric range. Measurements during several heavy rainstorms incorporating a period of steady infiltration rate were utilized to determine the saturated (or near-saturated, because of entrapped air) hydraulic conductivities of different soil horizons. Unsaturated hydraulic conductivities were obtained as usual from drainage data. Use of the monitored soil water pressure data under natural conditions in conjunction with the measured unsaturated soil properties to calculate deep percolation, infiltration-minus-evapotranspiration, and evapotranspiration was illustrated. (Lee-ISWS)
W80-02489

2H. Lakes

SEDIMENTATION AND USEFUL LIFE OF RESERVOIRS,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Civil Engineering.
M. A. Gill.
Journal of Hydrology, Vol 44, No 1/2, p 89-95, November 1979. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Sedimentation, *Reservoirs, *Trap efficiency, Reservoir silting, Hydrology, Equations, Mathematical studies, Effects, Sands, Silts, Silting, *Reservoir life, Brune's curves.

Analytical solutions were presented for calculating sedimentation and useful life of reservoirs using the trap efficiency relationships. Empirical equations were fitted to Brune's trap efficiency curves, and these equations were combined with the differential equation of the rate of reservoir sedimentation to produce the final solution. The final equations are simple and can readily be used in design calculations. (Lee-ISWS)
W80-02468

LIMNOLOGY OF TAYLOR CREEK IMPOUNDMENT WITH REFERENCE TO OTHER WATER BODIES IN UPPER ST. JOHNS RIVER BASIN, FLORIDA,
Geological Survey, Reston, VA. Water Resources Div., and Geological Survey, Tallahassee, FL. Water Resources Div.
D. A. Goolsby, and B. F. McPherson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A073 460, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-91, 1978. 95 p, 31 Fig, 21 Tab, 30 Ref.

Descriptors: *Water quality, *Limnology, *Impoundments, Reservoirs, Nutrients, Eutrophication, Thermocline, Hypolimnion, Organic matter, Phytoplankton, Water analysis, Evaluation, Florida, *Blue Cypress Lake(Fla), Upper St. Johns River.

Taylor Creek Impoundment, on the western part of the upper St. Johns basin, Fla., provides flood control and flow regulation. The 4,000-acre impoundment was first filled in 1969. The water was of relatively poor quality during the first three years of its existence, 1970-72. The impoundment is deep enough for thermal stratification, and a thermocline usually develops at 8 to 10 feet. During 1970-72 the hypolimnion remained anaerobic for more than six months. The poor water quality is attributed to the decomposition of flooded vegetation, of soil organic matter, and to heavy growths of phytoplankton and duckweed stimulated by an abundant supply of nutrients. Since 1972, the quality of the water has improved because of flushing of the impoundment and depletion of leachable nutrients and soil organic matter. The water is now similar in quality to that of nearby Wolf and Jane Green Creeks. Large releases of water may produce velocities great enough to resuspend bottom sediments several miles downstream where Taylor Creek flows into Lake Poinsett. (Woodard-USGS)
W80-02583

RANGE OF INDEPENDENT MIXTURE MODELS IN HYDROLOGY,
Technical Univ. of Istanbul (Turkey), Dept. of Hydraulics and Water Power.
For primary bibliographic entry see Field 2E.
W80-02587

WATER AND NUTRIENT TRANSPORT VIA GROUNDWATER FROM WARD VALLEY INTO LAKE TAHOE,
California Univ., Davis. Inst. of Ecology.
S. L. Loeb, and C. R. Goldman.
Limnology and Oceanography, Vol 24, No 6, p 1146-1154, November 1979. 6 Fig, 2 Tab, 23 Ref. NSF GI-22.

Descriptors: *Groundwater, *Groundwater movement, *Lakes, *Nutrients, Water chemistry, Aquifers, Pumping, Transmissivity, Sampling, Geology, Nitrogen, Nitrates, Phosphorus, Dissolved oxygen, Hydrogen ion concentration, Water temperature, Water levels, Water pollution, Water pollution sources, Pollutants, Path of pollutants, *Lake Tahoe, *Ward Valley(CA).

The amount of groundwater transported from the Ward Valley watershed into Lake Tahoe during the 1975 water year was 4,100,000 cu m. This was 16% of the water volume carried by Ward Creek and 10% of the total precipitation within the watershed during the same period. Of the total nutrient loading of Lake Tahoe from the Ward Valley watershed, goundwater contributed 49% of the total nitrate-nitrogen and 44% of the total soluble phosphorus loads. Groundwater may be a significant souce of water and dissolved nutrientw for Lake Tahoe, particularly in the littoral zone. (Sims-ISWS)
W80-02669

NUTRIENT DEPENDENCE OF PRIMARY PRODUCTIVITY IN LAKES,
Minnesota Univ., Minneapolis. Limnological Research Center.
V. H. Smith.
Limnology and Oceanography, Vol 24, No 6, p 1051-1064, November 1979. 7 Fig, 1 Tab, 68 Ref.

Descriptors: *Nutrients, *Primary productivity, *Lakes, Photosynthesis, Chlorophyll, Water chemistry, Turbidity, Nitrogen, Phosphorus, Sampling, Chemical analysis, Analytical techniques, Correlation analysis, Oxygen, Dissolved oxygen, Hypolimnion, Limnology.

An analysis of growing season measurements of daily primary productivity, chlorophyll, water chemistry, and transparency form 58 north temperate lakes showed a strong correlation between volumetric rates of photosynthesis, chlorophyll, and nutrients. Mean daily rates of photosynthesis per unit volume euphotic zone were correlated with mean chlorophyll concentration (r sq = 0.80). The mean daily rate of photosynthesis at optimal depth was highly correlated with mean total P(r sq = 0.95), and with mean total N(r sq = 0.91). In contrast, integral rates of photosynthesis were linked less tightly to nutrient concentration because of their simultaneous dependence on transparency. The Dillon-Rigler phosphorus loading model was extended to predict volumetric rates of photosynthesis in lakes where the N:P balance indicates control by phosphorus (N:P greater than 13). (Sims-ISWS)
W80-02671

PARTICULATE METALS IN WATERS OF A TYPICAL IRRIGATION RIVER: THE RIVER SAKURAGAWA, JAPAN,
Tsukuba Univ. (Japan). Inst. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W80-02683

DYNAMICS OF DISSOLVED OXYGEN IN A HYPEREUTROPHIC LAKE: LAKE KASUMIGAURA, JAPAN,
Tsukuba Univ. (Japan). Inst. of Biological Sciences.
K. Kuroiwa, Y. Ogawa, H. Seki, and S. Ichimura.
Water, Air, and Soil Pollution, Vol 12, No 2, p 255-264, August 1979. 3 Fig, 3 Tab, 9 Ref.

Descriptors: *Dissolved oxygen, *Lakes, *Eutrophication, *On-site tests, On-site investigations, Oxygen requirements, Dystrophy, Chlorophyll, Respiration, Productivity, Limnology, Distribution, Foreign research, Data collections, Euphotic zone, *Japan, *Lake Kasumigaura(Japan), Adenosine triphosphate.

The dynamics of dissolved oxygen (DO) were studied during a typical wind condition for each season in Lake Kasumigaura, a hypereutrophic lake. Vertical and diel fluctuation of DO was extremely dynamic during the summer algal bloom in August. The daily oxygen budget at the water surface showed that oxygen dissolving into lake water from the atmosphere was 0.66, 1.18, and 0.65 mg 02/sq cm in November, January, and April, respectively. During the blue-green algal bloom in August, on the other hand, DO liberated 1.16 mg 02/sq cm/day. As the vertical transport of DO for the typical local-wind (1 to 2 m/s) was only one order of magnitude greater than for at the windless condition, the stability of oxygen conditions in the dysphotic zone could not be disturbed greatly by the wind stress. (Humphreys-ISWS)
W80-02684

DEPOSITION OF NUTRIENTS AND MAJOR IONS BY PRECIPITATION IN SOUTH-CENTRAL ONTARIO,
Ontario Ministry of the Environment, Rexdale (Ontario). Limnology and Toxicity Section.
W. A. Scheider, W. R. Snyder, and B. Clark.
Water, Air, and Soil Pollution, Vol 12, No 2, p 171-185, August 1979. 4 Fig, 4 Tab, 43 Ref.

Descriptors: *Water pollution sources, *Precipitation(Atmospheric), *On-site investigations, *Lakes, *Canada, Ions, Water properties, On-site data collections, Nutrients, Fallout, Phosphorous, Nitrogen, Nitrates, Watersheds(Basins), Pollutants, Iron, Hydrogen, Calcium, Magnesium, Sodium, Potassium, Sulfates, Chlorine, *Harp Lake(Ontario).

As part of a study of the substance budgets of lakes in south-central Ontario, a network of precipitation collectors (8 bulk, 7 wet only) was operated to measure the deposition of nutrients and major ions. Results were reported for total P, total Kjeldahl N, NO3(-)-N; and total N H4(+)-N; and total N, Fe, H(+), Ca(++), Mg(++), Na(+), K(+) SO4(--), and CL(-), for a two year period (August 1976-July 1978). On an equivalent basis, the dominant anion in both bulk and wet precipitation was SO4(--), with H(+) the dominant cation. Precipitation in the study area is more acidic than that analyzed at any other location on the Canadian Shield to date. Concentrations of ions varied by 1 to 3 orders of magnitude between individual precipitation events and annual deposition varied by as much as 2-fold in the two years of study. Annual wet deposition contributed greater than 60% of bulk deposition for all substances except total P. Seasonal trends in deposition with summer maxima were noted for most ions. For Harp Lake, a small Precambrian Lake with a lake area of 12.6% of its total drainage area, precipitation input directly to the lake surface was an important source of nutrients and major ions. This was especially the case for P, N, and H(+) because these substances were retained by the terrestrial drainage basin. (Humphreys-ISWS)
W80-02685

THE EFFECT OF HEAVY METALS AND OTHER POLLUTANTS ON THE SEDIMENTS OF ONONDAGA LAKE,
Syracuse Univ., NY. Dept. of Civil Engineering.
S. W. Effler, M. C. Rand, and T. A. Tamayo.
Water, Air, and Soil Pollution, Vol 12, No 2, p 117-134, August 1979. 8 Fig, 6 Tab, 27 Ref.

Descriptors: *Water pollution sources, *Heavy metals, *Sediments, *Lakes, *New York, Water pollution, Pollutants, Water chemistry, Lead, Calcium, Iron, Phosphorous, On-site investigations, Water properties, Biochemical oxygen demand, Alkalinity, Copper, Zinc, Chromium, Industrial wastes, On-site data collections, Profiles, *Onondage Lake(NY).

Onondaga Lake is a small, highly polluted lake located within Metropolitan Syracuse, New York. The Lake has received the domestic effluents and much of the industrial wastes from the area during the last century of its development. Physical and chemical characterization of the recent sediments of Onondaga Lake indicates significant pollution based alterations to the system. 210Pb data depict an extremely high sedimentation rate within the consolidated layers (5 to 9 cm/yr) that has resulted largely from the loading of the Lake with industrially derived Ca. A further alteration of the sedimentary system is the very extensive flocculent layer (up to 2.5 m deep) between the overlaying water and the consolidated sediments. The chemistry of the sediments, though not unusual in dominant component makeup for a hardwater lake, is characterized by very severe heavy metal and Fe contamination that has resulted from culturally derived loadings. Heavy metals and P are concentrated within the upper flocculent strata. Indirect evidence was presented for the upward vertical migration of heavy metals within the sedimentary system. (Humphreys-ISWS)
W80-02686

MECHANICS OF SEDIMENT TRANSPORTATION AND ALLUVIAL STREAM PROBLEMS,
Roorkee Univ. (India).
For primary bibliographic entry see Field 2J.
W80-02700

2J. Erosion and Sedimentation

MATHEMATICAL MODEL OF HEAVY METAL TRANSFER AND TRANSPORT IN LAKE ERIE,
Bowling Green State Univ., OH. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W80-02407

SEDIMENTATION AND USEFUL LIFE OF RESERVOIRS,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W80-02468

COMPOSITION, INTERNAL STRUCTURES, AND AN HYPOTHESIS OF FORMATION FOR DRUMLINS, WAUKESHA COUNTY, WISCONSIN, U.S.A.,
Wisconsin Univ.- Madison. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2C.
W80-02481

THE MECHANICS OF DRUMLIN FORMATION WITH PARTICULAR REFERENCE TO THE CHANGE IN PORE-WATER CONTENT OF THE TILL,
Brock Univ., St. Catharines (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2C.
W80-02482

POTENTIAL HAZARDS FROM FLOOD-FLOWS AND DEBRIS MOVEMENT IN THE FURNACE CREEK AREA, DEATH VALLEY NATIONAL MONUMENT, CALIFORNIA-NEVADA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. R. Crippen.
Geological Survey open-file report 79-991, July 1979. 23 p, 8 Fig, 1 Tab, 9 Ref.

Descriptors: *Flood flow, *Debris avalanches, *Hazards, *Arid lands, *Deserts, Mountains, Cloudbursts, California, Nevada, *Death Valley National Monument, *Furnace Creek area(CA), Funeral Mountains(CA).

Death Valley is known as the driest and hottest region in the United States. Despite the aridity of the valley itself, however, very heavy rainfall sometimes occurs in the nearby mountains. Such violent rainstorms are likely to be of relatively

short duration and to occur over rather small areas; nevertheless, they sometimes produce large floodflows that in turn cause severe erosion and flows of debris. The debris-laden flows may be hazardous to life and property. Given sufficient knowledge of the hydrologic and hydraulic environment, the degree of hazard can be estimated. Potential hazards are defined for areas in the vicinity of the Furnace Creek fan and the Park Service residential area. (Woodard-USGS)
W80-02591

ASSESSMENT OF SEDIMENT TRAP COLLECTION EFFICIENCY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
B. T. Hargrave, and N. M. Burns.
Limnology and Oceanography, Vol 24, No 6, p 1124-1136, November 1979. 3 Fig, 1 Tab, 17 Ref.

Descriptors: *Sediments, *Sampling, *Instrumentations, Theoretical analysis, On-site investigations, Turbulence, Mixing, Sedimentation rates, Suspended solids, Sedimentation, *Sediment traps.

Theoretical considerations of the effects of turbulence around and within sedimentation traps showed that the aspect ratio (height:mouth opening) of the traps is important in determining particle retention. Collection efficiency and comparative measures of deposition per unit area in traps of various design were independent of this ratio in calm water, but an asymptotic relation of increased collection efficiency with higher aspect ratio existed under nonstagnant conditions. Turbulent mixing in a water column could be assessed by comparisons of deposition in collectors exposed simultaneously but having different aspects ratios. (Sims-ISWS)
W80-02670

AMINO ACID DIAGENESIS AND ADSORPTION IN NEARSHORE ANOXIC SEDIMENTS,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
J. K. Rosenfield.
Limnology and Oceanography, Vol 24, No 6, p 1014-1021, November 1979. 3 Fig, 3 Tab, 29 Ref. NSF 73-00365/GA-40002.

Descriptors: *Diagenesis, *Adsorption, *Amino acids, *Sediments, Sampling, Coasts, Shores, Chemical analysis, Analytical techniques, Laboratory tests, Bacteria, Organic matter, Sediment-water interfaces, Tidal waters, Nearshore sediments, Anoxic sediments.

Amino acid diagenesis and free amino acid adsorption by sediments were studied in cores of nearshore anoxic sediments from Long Island Sound, Florida Bay, and Pettaquamscutt River (Rhode Island). Both organic nitrogen and amino acid content decreased by a factor of about 2 in the top meter of the sediment. Individual amino acid profiles showed that the acidic and neutral amino acids, despite their different chemical composition, appeared to be equally utilized in both clastic and carbonate sediments. This result differed from the preferential utilization of certain amino acids generally found in deep-sea sediments. The results of laboratory adsorption experiments suggested that in clay sediments, free amino acids are predominantly adsorbed by the organic matter in the sediment rather than by the clay minerals. However, in the carbonate sediments, the organic matter seems to inhibit the adsorption of free amino acids on the carbonate grains. (Sims-ISWS)
W80-02673

MECHANICS OF SEDIMENT TRANSPORTATION AND ALLUVIAL STREAM PROBLEMS,
Roorkee Univ. (India).
R. J. Garde, and K. G. Ranga Raju.
John Wiley and Sons, New York, New York, 1977. 483 p.

Descriptors: *Alluvial channels, *Sediment transport, *Sediment load, *Publications, *Hydraulic engineering, *Sedimentation, Hydraulics, Theoretical analysis, Analytical techniques, Sediments, Bed load, Equations, Sediment control, Model studies, Bed load samplers, Sampling, Rivers, Canals, River training, Bank protection, Channel erosion, Scour, Sediment discharge, Density currents, Reservoirs, Saltation, Incipient motion.

The subjects of sediment transport and flow in alluvial streams are gaining importance with the increasing utilization of water resources. In this book the authors attempted to summarize and synthesize the vast amount of information on sediment transport and problems related to alluvial streams scattered in numerous journals, monographs, and other research publications. The contents of the book were divided into two parts. The first part, consisting of 8 chapters, dealt with the theory of sediment transport and included such aspects as properties of sediments, incipient motion condition, flow regimes, resistance to flow, bed load transport, suspended load transport, and total load transport. The second part, consisting of another 8 chapters, dealt with applied problems such as sediment samplers and sampling, stable channels, alluvial streams, variations in stream bed elevation and plan forms, sediment control, river training, and miscellaneous problems such as model studies, mud flows, density currents, and sediment transport through pipes. (Humphreys-ISWS)
W80-02700

2K. Chemical Processes

THE EFFECT OF HYDROGEOLOGY ON VARIATIONS IN THE ELECTRICAL CONDUCTIVITY OF GROUNDWATER FLUCTUATIONS,
Andhra Univ., Waltair (India). Dept. of Geophysics.
For primary bibliographic entry see Field 2F.
W80-02412

DESIGN OF A NETWORK FOR MONITORING GROUND-WATER QUALITY IN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-02588

SELECTED WELL INVENTORY AND CHEMICAL ANALYSIS OF GROUND WATER, PARTS OF MISSOULA AND POWELL COUNTIES, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-02590

AN EPR STUDY OF THE REDUCTION OF VANADIUM(V) TO VANADIUM(IV) BY FULVIC ACID,
New Hampshire Univ. Durham. Dept. of Chemistry.
For primary bibliographic entry see Field 1A.
W80-02601

ACID PRECIPITATION: MEASUREMENT OF PH AND ACIDITY,
Virginia Univ., Charlottesville, Dept. of Environmental Sciences.
J. N. Galloway, B. J. Cosby, Jr., and G. E. Likens.
Limnology and Oceanography, Vol 24, No 6, p 1161-1165, November 1979. 1 Fig, 17 Ref. NOAA 04-5-022-24.

Descriptors: *Acidity, *Hydrogen ion concentration, *Measurement, *Analytical techniques, Water chemistry, Acids, Chemical analysis, Water pollution, Pollutants, Sampling, Monitoring, Chemistry, Precipitation(Atmospheric), *Acid precipitation.

The pH and acidity of precipitation are difficult to measure accurately because of the low ionic strength of the samples. Use of measured pH to estimate hydrogen-ion concentration may err by as much as 50% if activity coefficients, junction and streaming potentials, and non-Nernstian behavior of the electrode system are ignored. The magnitude of the individual errors was assessed, and procedures for measuring pH and acidity to reduce the total error to + or - 5% were recommended. (Sims-ISWS)
W80-02667

ACIDIFICATION AND OTHER CHEMICAL CHANGES IN HALIFAX COUNTY LAKES AFTER 21 YEARS,
Fisheries and Marine Service, Halifax (Nova Scotia).
W. D. Wyatt, D. Scott, and S. Ray.
Limnology and Oceanography, Vol 24, No 6, p 1154-1161, November 1979. 1 Fig, 4 Tab, 8 Ref.

Descriptors: *Lakes, *Acidity, *Water chemistry, *Sampling, Air pollution, Air pollution effects, Precipitation(Atmospheric), Chemicals, Sodium, Magnesium, Calcium, Potassium, Sulfates, Hydrogen ion concentration, Geology, Rocks, Runoff, Chemical analysis, Data processing, Regression analysis, *Nova Scotia, Acid precipitation.

Of 23 lakes sampled in 1955, 16 show no sign of significant physical alterations within their drainage basins over a 21-year interval, so that chemical changes in these lakes can be assumed to reflect changes in atmospheric inputs. In all 16, the pH levels have declined, with greater declines in the higher pH (near neutrality) lakes. After correction for sea-salt input, concentrations of sodium, magnesium, calcium, potassium, and sulfate show no significant change. Sulfate and hydrogen ions are significantly correlated, and both show significant regressions on distance from the major sulfur-emitting industrial sources in the Halifax area. Although the area as a whole may be subject to an influx of acid pollutants via long distance atmospheric transport, for lakes near Halifax the high acid levels largely are due to local pollution. (Sims-ISWS)
W80-02668

HYDROGEOCHEMISTRY OF THE CORSAGLIA VALLEY, MARITIME ALPS, PIEDMONT, ITALY,
Turin Univ (Italy). Ist. di Geologia e Paleontologia.
For primary bibliographic entry see Field 2F.
W80-02679

2L. Estuaries

THE BARNACLE, BALANUS SUBALBIDUS, AS A SALINITY BIOINDICATOR IN THE OLIGOHALINE ESTUARINE ZONE,
New Orleans Univ., LA. Dept. of Biological Sciences.
M. A. Poirrier, and M. R. Partridge.
Estuaries, Vol 2, No 3, p 204-206, September 1979. 4 Fig, 6 Ref. OWRT A-045-LA(1).

Descriptors: *Estuaries, *Salinity, *Bioindicators, *Gulf of Mexico, Biological communities, Size, Marine biology, Biology, Sampling, Surveys, Coasts, Analytical techniques, Regression analysis, Barnacles, Oligohaline zone.

The distribution and size of the barnacle Balanus subalbidus were studied along salinity gradients in coastal Louisiana and Mississippi. It was common in gradient estuaries occurring in salinities ranging from near freshwater to 16 ppt. It was the dominant barnacle species in the oligohaline zone. But at salinities above 6 ppt, its relative abundance decreased, and it was replaced by B. improvisus and B. eburneus. Its low-salinity limit corresponded to the boundary between the oligohaline and freshwater estuarine salinity zones and there was a high negative correlation between size (basal rostral-carinal diameter) and salinity. Its size and distribution could be used to determine prevailing salinity at a site because of its abundance and uniform distribution in oligohaline areas. (Sims-ISWS)
W80-02413

PROPERTIES OF THE SEAWATER-AIR INTERFACE. DYNAMIC SURFACE TENSION STUDIES,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
Dj. Dragcevic, M. Vukovic, D. Cukman, and V. Pravdic.
Limnology and Oceanography, Vol 24, No 6, p 1022-1030, November 1979. 7 Fig, 27 Ref.

Descriptors: *Air-water interfaces, *Sea water, *Surface tension, *Laboratory tests, Films, Thin films, Oils, Organic compounds, Chemicals, Equipment, Instrumentation, Hydrogen ion concentration, Oceans, Oceanography, Oleic acid, Surface layers.

The properties of the seawater-air interface were studied by laboratory measurement of the dynamic surface tension of seawater and of samples of artificial seawater on which films of oleic and stearic acid were spread. A commercially available, automatic recording apparatus was used, consisting of a modified Langmuir trough with motor-driven surface wiper blades, a Wilhelmy plate surface tension electric microbalance, and a recorder. Comparison of the shape of the dynamic surface tension-surface area curves of original seawater samples with those of artificial ones showed that the 'expanded-' type surface film, produced by surface spreading of oleic acid, serves as an adequate model of conditions at the real seawater-air interface. This model and its surface tension dynamics could be used, in addition to chemical analytical data, as a quantitative measure of the state of the seawater-air interface and its role in controlling the transport of gases and other soluble materials between the atmosphere and the oceans. (Sims-ISWS)
W80-02672

AMINO ACID DIAGENESIS AND ADSORPTION IN NEARSHORE ANOXIC SEDIMENTS,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W80-02673

MASS TRANSFER VERIFICATIONS OF TIDAL FROUDE MODELS,
Old Domnion Univ., Norfolk, VA.
C. Blari, and C. Y. Kuo.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY12, p 1561-1565, Technical Note, December 1979. 1 Tab, 19 Ref, 1 Append.

Descriptors: *Hydraulic models, *Tidal waters, *Mass transfer, *Estuarines, Model studies, Froude number, Calibrations, Tracers, On-site investigations, Mixing, Reviews, Coasts, Model verification.

Similitude of tidal hydraulic models is routinely verified with respect to model/prototype tide heights and current velocities and, in mass transfer (i.e., spatial and temporal distribution of a pollutant, dye tracer, or similar dissolved substance) is less frequently investigated, chiefly because of the prohibitive cost of protopype dye release tests. Laboratory-field verification tests reported from 1966-1976 demonstrated that mass transfer similitude has in fact been attained in models of widely varying scale, distortion, and hydraulic characteristics. For more detailed information on the verification tests one must turn to the references or, in some cases, to the investigators themselves for information on tracers used, vertical tracer distribution, nature of model friction elements, river discharge and tidal data, morphology and hydrography of the water bodies, and other information essential for analyzing the results. Given the difficulty and expense of such studies, further and deeper analysis of already completed experiments should be an efficient approach to 'continued improvements in understanding' the mixing process. (Humphreys-ISWS)
W80-02695

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

ADVANCED POLY(PIPERAZINEAMIDE) REVERSE OSMOSIS MEMBRANES,
FilmTec Corp., Minnetonka, MN.
J. E. Cadotte, R. S. King, and N. A. Newkumet.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127574, Price codes: A04 in paper copy, A01 in microfiche. Final Technical Progress Report to the Office of Water Research and Technology, 1979. 48 p, 20 Tab, 6 Ref. OWRT C-80011-S(8512)(1), 14-34-0001-8512.

Descriptors: *Reverse osmosis, *Permselective membranes, *Semipermeable membranes, *Desalination processes, Membranes, Membrane processes, Saline water, Polypiperazineamide, Piperazine.

Poly(piperazineamide) thin-film composite reverse osmosis membranes were prepared by interfacially reacting piperazine compounds with a mixture of isophthaloyl and trimesoyl acid chlorides. Reaction of piperazine itself with these acylhalides gave membranes with high flux and excellent salt rejections towards salts with divalent anions, but relatively poor salt rejections toward salts with monovalent anions. About 95% seawater rejections were possible. A variety of water-soluble, amine-terminated piperazine oligomers were prepared by reaction of an excess of piperazine with polyfunctional acyl halides. These were then used in the above interfacial reaction step. Cyanuric chloride-piperazine adducts showed performance advantages over other in preparation of reverse osmosis membranes interfacially. In seawater tests at 1000 psi and 25C, fluxes of 15 to 20 gfd at 97 percent salt rejection were attainable for poly(piperazineamides) containing cyanuric amide segments. These latter membranes were not chlorine-resistant.
W80-02401

SECONDARY ICE NUCLEATION AND CRYSTALLIZER-PERFORMANCE OPTIMIZATION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
E. Woltz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-130446, Price codes: A03 in paper copy, A01 in microfiche. Doctoral Thesis Digest, August 1975. 31 p, 19 Ref. OWRT (3268)(2), 14-30-3268.

Descriptors: *Desalination, *Freezing, *Crystal growth, Crystallization, Nucleation, Supercooling, Potassium chloride, Sodium chloride.

A batch crystallizer was used to investigate the secondary nucleation of ice in NaCl and KCl solutions. The kinetics of nucleation were determined over a range of salt concentrations, agitation power inputs, and solution subcoolings. The nucleation kinetics were found to be consistent with a mechanism in which the nuclei were produced by collisions between the ice crystals and the impeller and crystallizer surfaces. The specific nucleation rate was found to be preportional to the third moment of the particle size distribution. The data were used to develop a correlation of the nucleation rate as a function of subcooling, power agitation rate, and the third moment of the size distribution. (Sarofim-MIT)
W80-02608

HYDRODYNAMIC AND HEAT TRANSFER EFFECTS IN A PACKED BED MELTER-CONDENSER,
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
W. L. Sifleet.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-132657, Price codes: A03 in paper copy, A01 in microfiche. Doctoral Thesis Digest, January 1975. 28 p, 6 Fig, 41 Ref. OWRT (3268)(3), 14-20-3268.

Descriptors: *Heat transfer, *Condensation, *Desalination, Freezing, Crystal growth.

Data are presented on liquid-phase hold-up and on heat transfer for geometries similar to those which are likely to be employed in a packed bed melter-condenser. Hold-up was studied in a string-of-spheres column for water, for aqueous sucrose solutions, and for suspensions of polyethylene particles in water. The data for water and for sucrose solutions show excellent agreement with a new theory which as been developed for this purpose. Rather surprisingly, the suspensions of polyethylene behaved exactly as did water alone. Heat transfer rates were studied for the condensation of n-butane upon a film of cold water which as caused to flow over a single sphere. The results are in satisfactory agreement with simple penetration theory. (Smith-MIT)
W80-02609

MASS TRANSFER FROM SPHERES AND DISCS IN TURBULENT AGITATED VESSELS,
Massachusetts Inst. of Technology, Cambridge, Dept. of Chemical Engineering.
P. H. Wadia.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-132640, Price codes: A05 in paper copy, A01 in microfiche. Doctoral Thesis Digest, 1974. 95 p, 39 Fig, 7 Tab, 29 Ref. OWRT (3268)(4), 14-20-3268.

Descriptors: *Mass transfer, *Desalination, *Freezing, Crystal growth.

Mass transfer coefficients for virtually neutrally buoyant spheres and discs were measured by observing the rate of dissolution of sparingly soluble organic solutes in water and water-glycerol solutions. An extensive experimental investigation of all the important independent transport variables was conducted, with special emphasis on studies with industrial scale equipment. The variables studied were: vessel diameter, impeller design, type and geometry, impeller location, impeller to tank diameter ratio, liquid height, impeller speed and the specific power input, particle diameter, particle concentration, solute diffusivity, and fluid viscosity. A theory is developed on the basis of Kolmogoroff's notion of locally isotropic turbulence, and generalized correlations which are consistent with the proposed theory are presented. Attention is drawn to the mass transfer limited growth of ice crystals. (Smith-MIT)
W80-02610

PROCESS AND APPARATUS FOR PURIFYING SEA WATER BY REVERSE OSMOSIS,
Permo SA, Rueil Malmaison (France). (Assignee).
H. Lerat.
U.S. Patent No 4,169,789, 11 p, 2 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 987, No 1, p 168-169, October 2, 1979.

Descriptors: *Patents, *Desalination, *Water purification, *Water treatment, *Sea water, Reverse osmosis, Filtration, Semipermeable membranes, Offshore platforms, Potable water.

Sea water is purified by reverse osmosis in an offshore installation where sea water is withdrawn from the sea by a low pressure pump and passed through plural-stage physical filters having decreasing degrees of porosity to remove suspended particles and colloids from the sea water. The filtered sea water is then fed by a high pressure pump, at a controlled pressure above the osmotic pressure of the sea water to a reverse osmosis module. A portion of the sea water permeates through a semipermeable membrane of the module to form purified potable water and the remaining sea water having its dissolved salt concentration increased, is discharged back to the sea. The reverse osmosis module is operated so that the conversion level, measured in percent and equal to the volume of purified water divided by the volume of sea water fed to the module, is maintained below a maximum value to prevent the formation of sulfates and carbonates on the membrane. (Sinha-OEIS)

Group 3A—Saline Water Conversion

W80-02629

DESALINATION BY THE INVERSE FUNCTION OF THE KNOWN (SALTING OUT) EFFECT WITHIN AN IMPROVED CENTRIFUGE,
S. A. Kirk, and C. F. Kirk.
U.S. Patent No 4,170,328, 6 p, 1 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 987, No 2, p 358, October 9, 1979.

Descriptors: *Patents, *Desalination, *Water purification, Sea water, Separation techniques, Hydrogen, Gases, Centrifugation, Recycling, 'Salting out' effect.

Hydrogen gas is injected into sea water preceding treatment in an improved pocket type centrifuge. The catalytic effects of hydrogen gas within the confining walls plus hydraulic, inertia, and centrifugal forces acting within the centrifuge give an inverse function of the known salting-out effect in which the hydrogen rejects the salt and floats the freshwater from the system. The hydrogen gas is separated from the fresh-water by a second improved pocket type centrifuge and recycled for efficiency in the process. (Sinha-OEIS)
W80-02633

APPARATUS FOR THE DESALINATION OF SEA WATER, WITH AUTOMATIC REGULATION OF THE FRESH AND SALT WATER LEVELS,
Snam Progetti, S.p.A., Milan (Italy). (Assignee).
G. Pagani.
U.S. Patent No 4,170,514, 4 p, 4 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 987, No 2, p 415, October 9, 1979.

Descriptors: *Patents, *Desalination, *Water treatment, *Sea water, Separation techniques, Flash distillation, Desalination apparatus.

In a sea water desalination apparatus, the improvement consists in the fact that the levels of sea water and fresh water in the several stages of the multistage installation are regulated by a device comprising of piezometric tubes in combination with cylindrical sleeves surrounding these tubes and having slots so proportioned as to give a preselected pressure drop. (Sinha-OEIS)
W80-02636

3C. Use Of Water Of Impaired Quality

GEOTHERMAL: AN IDEA WHOSE TIME HAS COME...,
For primary bibliographic entry see Field 8A.
W80-02662

3E. Conservation In Industry

METHOD AND APPARATUS FOR RECYCLING WATER IN A CAR WASH,
M. K. Allen, and R. S. Weber.
U.S. Patent No 4,168,231, 6 p, 4 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 986, No 3, p 662, September 18, 1979.

Descriptors: *Patents, *Industrial water, *Waste water treatment, *Separation techniques, Centrifugation, Recycling, Water conservation, Water reuse, Equipment, Car washes.

A pump supplies water from a clarifier tank to a centrifugal separator, where solid particles are removed, and then to wash spray heads. A return or bypass conduit with a pressure-operated, modulating one-way valve permits water to pass from the outlet of the separator to the inlet of the pump in sufficient volume to ensure that the separator will operate at high velocity even when there is little or no demand for processed water at the spray heads as well as to recycle centrifuged water to further clean it. A float tank is coupled to and extends from the return conduit for enabling any trapped air to be expelled from the system. In addition, an air-bleeding conduit with a one-way check valve is placed in parallel with the return conduit to permit air flow in the direction opposite to that allowed by the valve to enable air to be removed from the system, especially when the pump is primed by supply of additional water. (Sinha - OEIS)
W80-02616

APPARATUS FOR RECOVERY OF METALS FROM METAL PLATING BATHS AND NEUTRALIZING TOXIC EFFLUENTS THEREFROM,
Instytut Mechaniki Precyzyjnej, Warsaw (Poland).
For primary bibliographic entry see Field 5D.
W80-02643

SUPPRESSION OF POLLUTION IN MINERAL FIBER MANUFACTURE,
Saint-Gobain Industries, Neuilly-sur-Seine (France). (Assignee).
For primary bibliographic entry see Field 5D.
W80-02646

3F. Conservation In Agriculture

ROTARY SPRINKLER IMPACT ARM SPRING ADJUSTMENT,
Telsco Industries, Dallas, TX. (Assignee).
H. C. Ridgway.
U.S. Patent No 4,162,038, 10 p, 8 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 984, No 4, p 878-879, July 24, 1979.

Descriptors: *Irrigation, *Sprinkler irrigation, *Application equipment, Irrigation practices, Irrigation efficiency.

A rotary sprinkler has a laterally directed nozzle cooperating with the arm to rotate the nozzle and an impact arm journaled on a shaft extending above the nozzle. The arm is also mounted within a cage extending above the nozzle. The cage includes a pair of arms extending from the nozzle on opposite sides of the shaft and terminating at their upper ends remote from the nozzle in a top plate. A helical spring surrounds the shaft and is secured at its lower end to the arm. A bushing is secured at the top end of the spring and is seated in the top plate of the cage. The bushing may be manually adjusted relative to the plate to vary the force applied by the spring to the impact arm. The sprinkler is placed in a bucket-like housing positioned within the ground so that the mouth of the housing is flush with the ground surface. The sprinkler responds to the passage of water through the nozzle by rising from a lower first position retracted in the housing to a raised second position out of the housing. A top cover sized to mate with the mouth of the housing is attached to the top plate of the cage so that when the sprinkler is in the first position the top cover mates with the mouth of the housing to enclose the sprinkler. The top cover is supported above and protects the sprinkler. (Sinha-OEIS)
W80-02448

RECLAMATION POLICY AND THE WATER SUBSIDY, AN ANALYSIS OF THE DISTRIBUTIONAL CONSEQUENCES OF EMERGING POLICY CHOICES,
California Univ., Davis. Dept. of Agricultural and Resource Economics.
For primary bibliographic entry see Field 6B.
W80-02455

TWO-PIECE WEAR-RESISTANT SPRAY NOZZLE CONSTRUCTION,
Rain Bird Sprinkler Mfg. Corp., Glendora, CA. (Assignee).
R. von Bernuth, and D. Simpson.
U.S. Patent No. 4,168,033, 6 p, 6 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 986, No 3, p 603-604, September 18, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Irrigation operations and maintenance, Water delivery.

A spray nozzle is described having a brass housing and a urethane insert that is relatively resistant to wear by contact with the flow of irrigation water. The insert protects the more costly housing from erosion and is easily replaced if it becomes worn or if it is necessary to change the spray pattern. The housing can form a sleeve in which the insert is slidably received so that the housing is completely insulated from contact with the water flow. In one embodiment, the insert forms a concave defector having ridges on a surface impinged by the water so that the spray emitted consists of discrete streams for greater distance and wind resistance. The water is emitted toward the deflector through an oblong orifice for more uniform lateral water distribution. (Sinha-OEIS)
W80-02613

SOAKER HOSE,
Entek Corp., Dallas, TX. (Assignee).
J. E. Turner.
U.S. Patent No 4,168,799, 7 p, 7 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 986, No 4, p 861, September 25, 1979.

Descriptors: *Patents, *Irrigation, *Subsurface irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance.

A product is made of crumbed rubber and synthetic rubber reclaimed from rubber tires with the metal removed. It is ground to a relatively small granular size, such as would pass through a 30-mesh screen, process-mixed through an extruder, with a much smaller binder mix of primarily polyethylene, in the order of 25% by weight, and with approximately 0.5% of the mixture added sulphur and 0.5% oil (such as random mixed grades of automobile engine oil). The resulting product is useful as a soil watering soaker hose that has a high degree of flexibility along its length. During its progress through the extruder there is limited foaming from steam originating from absorbed moisture in the crumbed, reclaimed rubber tire material and from residual gases venting from the material mix causing some open cell fluid flow paths. The foaming with steam and gases also form labyrinth passegeways between the rubber tire granules and the polyethylene binder mix for seeping water to the exterior of the hose without soil-damaging water jets. The soaker hose is usable as a subsurface irrigation buried pipe. (Sinha-OEIS)
W80-02619

COMBINATION HYDRAULIC CYLINDER AND SHOCK ABSORBER,
Allied Products Corp., Chicago, IL (Assignee).
M. A. Quick.
U.S. Patent No 4,168,800, 6 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 986, No 4, p 861, September 25, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance.

Spray booms utilized for applying liquid fertilizer, water or the like, include a powered vehicle, towed vehicle, and an elongated boom generally attached in a cantilevered fashion with discharge nozzles being spaced longitudinally along the boom. The end of the boom attached to the vehicle is pivotally supported for swinging movement in a vertical plane about a fore-and-aft horizontal axis in order to adjust the position of the boom in a vertical plane. Due to the elongated nature of the boom, it is subject to considerable vertical oscillation, bouncing or swinging movement due to the vehicle passing over an uneven terrain. The object of this invention is to provide a combination hydraulic cylinder and shock absorber utilized to cushion and dampen the vertical swinging movement of the spray boom and also to adjust the position of the spray boom and to cushion and dampen the swinging movement of the boom at any adjusted position within the range of adjust-

ment provided by the hydraulic cylinder. (Sinha-OEIS)
W80-02620

AGRICULTURAL WATER PRESSURE GAUGE,
W. C. McMahan.
U.S. Patent No 4,169,386, 4 p, 3 Fig, 1 Ref; Official Gazette of the United States Patent Office, Vol 987, No 1, p 37, October 2, 1979.

Descriptors: *Patents, *Irrigation, Irrigation practices, Irrigation efficiency, Water pressure, Gages, Irrigation operation and maintenance, Farm equipment.

A water pressure gauge for agricultural use comprises no moving parts. A translucent tube has one end provided with a hollow prong or probe that penetrates flexible water conduit. The tube is open at the end opposite the probe and has an outlet opening located near the probe end. With the guage vertically oriented, water reaches a level in the tube dependent upon water pressure. By careful calibration of the outlet relative to an interior baffle, a reasonably satisfactory water pressure gauge is available for irrigation purposes. (Sinha-OEIS)
W80-02626

IRRIGATION PIPE GATE,
Traid Fastener Corp., Alda, NE. (Assignee).
H. E. Damratroski, and R. H. Morton.
U.S. Patent No 4,169,577, 6 p, 7 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 987, No 1, p 103, October 2, 1979.

Descriptors: *Patents, *Irrigation, Irrigation practices, Irrigation efficiency, Water control, Flow control, Pipe flow, Gates.

A longitudinally slidable irrigation pipe gate for opening and closing a longitudinally elongated outlet port in an irrigation pipe has a wall of given finite thickness. The port includes a transversely extending lead-end and a trail-end and at least a portion of the outlet port length is of regular transverse width. The pipe gate comprises a base member having an inner-plate for abuting against the inner surface of the pipe; a resilient annular gasket for providing a water-tight slidable seal between the inner-plate and the inner surface of the pipe; a cover member with extending edges abutting the outside surface of the pipe; and a spring means for connecting the cover member and the inner-plate and resiliently uring them toward the outside surface and the inside surface, respectively. The pipe gate has a closed forward position where the base member and gasket completely cover the periphery of the outlet port and an open rearward position where a portion of the outlet port is not covered. (Sinha-OEIS)
W80-02627

SPRINKLER AND VALVE OPERATOR,
A. N. Filan, and A. L. Filan.
U.S. Patent No 4,171,095, 7 p, 5 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 987, No 3, p 627, October 16, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Irrigation operation and maintenance, Irrigation efficiency, Irrigation practices.

A sprinkler and valve operator enables a single rotatable sprinkler head to be mounted coaxially to an upright irrigation pipe valve. The operator is comprised of two independently coaxially rotatable pipe sections that include a central valve operating mechanism. The lower pipe section includes mechanisms for attaching the operator to a standard upright irrigation pipe valve. The valve operating mechanism engages and rotates the irrigation pipe valve actuator in response to rotational movement of the upper pipe section. A removable tripod may be provided to brace the pipe sections against operating forces produced through the rotating sprinkler head. (Sinha-OEIS)
W80-02642

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

ENDOHELMINTHS OF SALMONIDA FROM THE ARTIFICIAL LAKE PIVA, MONTENEGRO, YUGOSLAVIA,
Biological Inst., Titograd (Yugoslavia).
For primary bibliographic entry see Field 5C.
W80-02490

HYDROLOGY AND WATER QUALITY IN THE NEDERLO CREEK BASIN, WISCONSIN, BEFORE CONSTRUCTION OF TWO WATER-RETENTION STRUCTURES,
Geological Survey, Madison, WI. Water Resources Div.
P. A. Kammerer, Jr., and M. G. Sherrill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 826, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-95, August 1979. 34 p, 21 Fig, 3 Tab, 16 Ref.

Descriptors: *Hydrologic budget, *Small watersheds, *Pre-impoundment, *Water quality, *Wisconsin, Baseline studies, Water temperature, Surface-groundwater relationships, Sediment yield, Hydrologic cycle, Dissolved oxygen, Hydrogeology, Surface runoff, Base flow, Potentiometric level, Geology, Land use, *Nederlo Creek(Wis), *Southwestern Wisconsin, Driftless area, Trout stream, Total nitrogen load, Total phosphorus load, Suspended-sediment load.

The Nederlo Creek basin in southwest Wisconsin is the proposed site of two structures intended to provide recreation and flood protection. Streamflow is fairly constant at base flow, but rapid changes in discharge occur during periods of snowmelt or heavy rain. Mean annual precipitation is 32.5 inches, and mean annual runoff is 6.4 inches. The water is a hard calcium magnesium bicarbonate type. Dissolved-oxygen concentrations in the stream are lowest during the summer when nighttime lows are generally between 7 and 8 milligrams per liter and daily maximums between 11 and 12.5 milligrams per liter. Considerable diurnal water-temperature fluctuation occurs in summer with daily maximum temperatures occasionally reaching 26 C. Estimates of mean annual total phosphorus and total nitrogen loads fall within the ranges of 0.02 to 0.07 and 0.4 to 0.8 tons per square mile, respectively; mean annual sediment loads range from 13 to 60 tons per square mile. Seventy to 80 percent of the total phosphorus, 35 to 55 percent of the total nitrogen, and 74 to 86 percent of the suspended sediment are transported during periods when surface runoff contributes to streamflow. (Woodard-USGS)
W80-02585

CHANGES IN CHANNEL GEOMETRY AND CHANNEL CAPACITY OF ALLUVIAL STREAMS BELOW LARGE IMPOUNDMENT STRUCTURES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Tai Huang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-132632, Price codes: A07 in paper copy, A01 in microfiche. MS Thesis, (1979), 131 p, 39 Fig, 4 Tab, 35 Ref, 2 Append. OWRT A-075-KAN (2).

Descriptors: *Alluvial streams, *Impoundment structures, *Channel morphology, Distribution patterns, Channel geometry, Channel capacity.

Alluvial streams are known to form their own channels, and the characteristics of the channels is in a state of equilibrium with the bank material, and water and sediment discharge patterns. Construction of large impoundment structures on alluvial streams alters their water and sediment discharge patterns. Changes in channel geometry and channel capacity are therefore induced. In this study, the changes in channel geometry and channel capacity caused by large impoundment structures are examined. The theories of fluvial morphology and the theories of open channel flow are used for analyses. Both approaches lead to a similar conclusion that the stream below a dam tends to form a relatively narrower and deeper channel. United States Geological Survey streamflow measurement data of seven Kansas streams are used to test this conclusion. Hydraulicaly, the morphological changes of the stream channel are attributed to channel degradation and increased channel roughness. A channel degradation model is presented and applied on the Wakarusa River below Clinton Dam. The result shows a maximum degradation of 11 feet which is probably too excessive. However, the result also indicates a consistent trend that has been predicted by the analyses. With carefully chosen values for the stream parameters, the model can be used satisfactorily to predict changes in channel geometry and channel capacity for a stream reach below a large impoundment structure.
W80-02611

ENDING ACID MINE WATER POLLUTION,
For primary bibliographic entry see Field 5D.
W80-02658

SWMM APPLICATION TO COMBINED SEWERAGE IN NEW HAVEN,
Cardinal Engineering Associates, Meriden, CT.
For primary bibliographic entry see Field 2E.
W80-02694

COMPARISON AND COMBINATION OF TWO RECENT PROPOSALS FOR A GENERALIZED PENMAN EQUATION,
Dar es Salaam Univ., Tanzania. Dept. of Physics.
For primary bibliographic entry see Field 2D.
W80-02699

4B. Groundwater Management

AVAILABILITY OF GROUND WATER ON FEDERAL LAND NEAR THE AK-CHIN INDIAN RESERVATION ARIZONA--A RECONNAISSANCE STUDY,
Geological Survey, Tucson, AZ. Water Resources Div.
R. P. Wilson.
Available from OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, microfiche $9.00, paper copy $8.25. Geological Survey open-file report 79-1165, June 1979. 36 p, 13 Fig, 3 Tab, 20 Ref.

Descriptors: *Groundwater availability, *Water wells, *Aquifer characteristics, *Water yield, *Water quality, Water levels, Indian reservations, Arizona, Water supply, Drawdown, Groundwater movement, Projections, Water resources development, Evaluation, *Ak-Chin Indian Reservation(Ariz).

Sufficient ground water to provide about 2.1 million acre-feet in a 25-year period is available for delivery to the Ak-Chin Indian Reservation from Federal land in the Vekol Valley, Waterman Wash area, and Bosque area in south-central Arizona. Withdrawal of 85,000 acre-feet per year as required by the Ak-Chin water-supply act--Public Law 95-328--will greatly deplete the amount of water in storage and may cause land subsidence in the areas. Study concurrent with well-field development will enable design changes to minimize pumping costs, water-level declines, movement of poor-quality water into the well fields, and potential land subsidence and associated earth fissures. Surface and bore-hole geophysical testing, aquifer tests, and the development of simulative mathematical models will accomplish these goals and permit quantitative evaluations of the potential deleterious effects resulting from development of the water supply. (Woodard-USGS)
W80-02581

GROUND WATER CONTROL TO THE RESCUE: TWO CASE HISTORIES,
Golder Associates, Mississauga (Ontario).
For primary bibliographic entry see Field 8H.
W80-02648

GROUND WATER STORAGE FOR CALIFORNIA WATER PROJECT,
California State Dept. of Water Resources, Los Angeles. Southern District.
J. J. Coe.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 105, No IR3, p 305-315, September, 1979. 5 Fig, 3 Ref.

Descriptors: *Conjunctive use, *Underground storage, *Ground water basins, California, Legal aspects, Institutional constraints, State governments, Local governments, Water resources development, Government interrelations.

Due to the expense and delay involved in constructing surface storage facilities, the California Department of Water Resources is examining the feasibility of using ground water basins. Under the State Water Project (SWP), water would be placed underground during periods of ample supply and withdrawn and used in subsequent dry years. This reduces wastage of water to saline bodies and increases the yield over that achievable from separate operation of surface water and ground water projects. Also storage of water would raise ground water levels and reduce pumping costs and would improve ground water quality in many basins. Recent state Supreme Court decisions have provided a strong legal framework for the practice of conjunctive use. Major institutional considerations involve competition between local and state agencies over the use of conveyance facilities, spreading basins, underground storage space and wells. These conflicts can often be solved by facility enlargement and scheduling. Local and state agencies should develop a plan for joint use of water supplies, facilities, and storage space to achieve local water management goals as well as increasing the yield of the SWP. (Purdin-NWWA)
W80-02663

4C. Effects On Water Of Man's Non-Water Activities

WATER QUALITY EFFECTS OF LEAD FROM RECREATIONAL BOATING,
California State Coll., Stanislaus, Turlock. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W80-02403

4D. Watershed Protection

MECHANICS OF SEDIMENT TRANSPORTATION AND ALLUVIAL STREAM PROBLEMS,
Roorkee Univ. (India).
For primary bibliographic entry see Field 2J.
W80-02700

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

AN INDICATOR-PREDICTION MODEL FOR ECOSYSTEM PARAMETERS OF WATER QUALITY,
Delaware Univ., Newark. School of Life Sciences.
M-H. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127228, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware, Newark, Research Project Technical Completion Report, November 1979, 10 p, 1 Fig, 1 Tab, 3 Ref. OWRT A-043-DEL(4), 14-34-0001-9008.

Descriptors: Water quality, Toxicity, Naphthalene, Fish, Cortisol, Glucose, Histopathology.

A mathematical model, based on fit to a rectangular hyperbola, has been developed for use in predicting the toxicity of chemical pollutants in fish. The model was tested by exposing Fundulus heteroclitus to a range of concentrations of naphthalene between 0 and 30 mg/L. Observations of mortality, condition index, tissue changes, and serum cortisol and glucose levels were tested as indicators of toxic effect. Mortality data obtained in these experiments were used to calculate the dose for which appearance of the response would require an infinite exposure time. This was defined as the 'safe level' for the indicator in question. Using mortality as the indicator, the model predicted the safe level to be 1.69 mg/L. This prediction appears to be valid since 1.73 mg/L was lethal at 15 days and no mortality occurred in fish exposed to 1.60 mg/L naphthalene for 30 days. Of the other toxicity indicators tested, only sensory cell necrosis was a more sensitive indicator of toxicity than mortality. Serum cortisol and glucose, and ischemia of brain and liver occurred only in animals which were near death. Condition index did not change in exposures as long as 30 days.
W80-02402

HEAVY METALS IN FISH FROM A RESERVOIR RECEIVING URBAN AND AGRICULTURAL RUNOFF,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
S. P. Gawlik, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127566, Price codes: A07 in paper copy, A01 in microfiche. MS Thesis, March 1979, 128 p, 4 Fig, 9 Tab, 103 Ref, 5 Append. OWRT B-103-VA(3).

Descriptors: *Nonpoint pollution, *Agricultural runoff, Heavy metals, Bass, Carp, Watershed, Reservoir, Spectrophotometry, *Occoquan watershed, Bluegill.

Between 3/24/78 and 5/26/78, largemouth bass, bluegill, and common carp were harvested from three stations in the Occoquan Watershed. Bass and bluegill were harvested from Pelham Reservoir which served as a control. Homogenized fillet and liver tissue from a total of 276 fish were digested and analyzed by Atomic Absorption Spectrophotometry for cadmium, chromium, copper, lead, zinc, and total mercury (1) to determine whether the amounts of metals represent any hazard to humans when fish are used as food; (2) to discover whether the geographical patterns of metal concentrations point to source areas or identify specific causes of elevated stream concentrations. Concentrations of mercury were shown to increase in the fillet tissue of carp, bass, and bluegill as a function of weight and length. Bass from both watersheds were occasionally found to exceed the guideline for total mercury. No other metals were shown to present any significant public health hazard. Zinc and copper concentrations in liver and fillet tissue of bass and bluegill from both watersheds were similar. However, zinc concentrations in the fillet of all fish were found to be greater than concentrations reported in the literature for uncontaminated waters while copper concentrations in the fillet corresponded well to values in the literature. Copper and zinc concentrations were higher in carp liver than values reported in the literature and when compared to liver concentrations from bass and bluegill in this report.
W80-02410

IMPACT OF WESTERN COAL MINING - II. MICROBIOLOGICAL STUDIES,
Montana State Univ., Bozeman. Dept. of Microbiology.
G. J. Olson, S. C. Turbak, and G. A. McFeters.
Water Research, Vol 13, p 1033-1041, 1979. 2 Fig, 4 Tab, 36 Ref. OWRT A-108-MONT(2).

Descriptors: *Sulfur bacteria, *Thiobacillus ferrooxidans, *Acid mine water, Strip mines, Mine drainage, Mine water, Mine wastes, Cytological studies, Coal mines, Hydrogen ion concentration, Montana, Carbonates, Tracers, Decker(Mont), Northeastern Wyoming.

The occurrence and activity of certain groups of sulfur cycle bacteria associated with waters, sediments, and the coal bearing strata of a coal strip mine at Decker, Montana, were studied. Mining areas in northeastern Wyoming were also examined. Thiobacillus ferooxidans, one of the major contributors to acid mine drainage, was consistently detected in the mining environment. Physiological studies of T. ferrooxidans isolates indicated that these acidophilic iron and sulfur oxidizing organisms were typical of the species in their preference for low pH and ability to oxidize pyrite. Since (1) acidic conditions were not observed at Decker, (2) the organisms did not multiply in mine water environments and (3) no acid could be formed from coal samples inoculated with a T. ferrooxidans isolate, it was thought that their activity was limited to microzones in the coal bearing strata where they oxidized sulfuritic material. Any acid formed was quickly neutralized by mineral carbonates associated with the groundwaters and overburden. Sulfate reducing bacteria also were common in the mine waters and sediments. These organisms were particularly active in the sedimentation pond sediments as was evidenced by the rapid rate of conversion of radio-labeled sulfate to sulfide. The hydrogen sulfide produced by these organisms contributed to heavy metal precipitation in the sedimentation pond. (Deal-EIS)
W80-02416

TRACE METAL CONCENTRATIONS IN SELECTED BIOLOGICAL, SEDIMENT, AND WATER COLUMN SAMPLES IN A NORTHERN NEW ENGLAND RIVER,
Academy of Natural Sciences Philadelphia, PA. Div. of Limnology and Ecology.
S. L. Friant.
Water, Air, and Soil Pollution, Vol 11, p 455-465, 1979. 5 Fig, 4 Tab, 12 Ref.

Descriptors: *Baseline studies, *Metals, *Absorption, Freshwater fish, Mollusks, Benthic fauna, Rivers, Aquatic plants, Water chemistry, Copper, Lead, Zinc, Mercury, Heavy metals, Chemical analysis, Bioindicators, *Tissue analysis, *Bioaccumulation, Maine, Kennebec River.

Analyses of metal concentrations in fish, mollusks and macrophytes from the Kennebec River present a good data base with which to compare the results of future work for the biological accumulation of metals. Analyses were also conducted on the water column and sediments to further enhance this study and to place values obtained for the biological specimens in proper perspective. Bottom-dwelling mollusks and rooted plants tend to accumulate metals found in the sediments and, in this study, metal concentrations in mollusks and plants greatly exceeded the values in sediments, fish and the water column. Concentrations of Cu, Pb and Zn were highest in plants, followed by mollusks and fish. Chromium values for mollusks were higher than those for plants and fish, while Hg values for mollusks were comparable to those for fish. Mollusks are apparently good accumulators of heavy metals and may provide long term indicators of general water quality. The levels of heavy metals found in this study suggest that rooted aquatic plants might be useful as indicators of metal contamination of a water system. It also suggests that with more intensive sampling of plant communities it may be possible to compare impact and reference stations by aquatic plant analysis along with sediments. (Deal-EIS)
W80-02417

EFFECTS OF CHLORINATED ORGANICS FROM WASTEWATER TREATMENT ON ALGAL GROWTH,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
M. S. Simmons, and K. Sivaborvorn.
Bulletin of Environmental Contamination and

Toxicology, Vol 23, p 766-773, 1979. 4 Tab, 17 Ref.

Descriptors: *Algae, *Growth rates, *Inhibition, *Chlorination, Sewage effluents, Waste water treatment, Chlorine, Chlorella, Anabaena, Bioassay, Toxicity, Organic wastes, Phytoplankton.

This study has shown that the major contribution for the growth inhibition of algae in the receiving waters of wastewater treatment plants can be attributed to the total residual chlorine in the effluents. It is also suggested that upon removal of the residual chlorine, the inhibitory effects could be due to the chloro-organic compounds which are produced during the chlorination treatment of the effluents. Extrapolations of the results of this study to the natural environment need to consider that the contents of the effluents change during short time intervals and that the natural algal population in the receiving waters consists of diverse species. (Deal-EIS)
W80-02420

ACUTE TOXICITY OF TWO MOLLUSCICIDES, MERCURIC CHLORIDE AND PENTACHLOROPHENOL TO A FRESHWATER FISH (CHANNA GACHUA),
Marathwada Univ., Aurangabad (India). Dept. of Zoology.
M. M. Hanumante, and S. S. Kulkarni.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 725-727, 1979. 1 Tab, 14 Ref.

Descriptors: *Bioassay, *Toxicity, *Molluscicides, Commercial fish, Mercury, Chlorides, Sodium compounds, Pesticide toxicity, Snails, Mortality, Fish physiology, *Channa, *Sodium pentachlorophenate.

Mercuric chloride and sodium pentachlorophenate (NaPCP) are commonly used molluscicides in curbing the population of freshwater vector snails which transmit the trematode larvae that are of medical and economic importance. As an effluent, HgCl2, and because of its use as a broad spectrum biocide, NaPCP, contaminate the water bodies throughout the world and thereby act as toxicants for extra-molluscan biota. The toxic effects of these two compounds was evaluated in the important food fish, Channa gachua. Static bioassays were performed on adult fish and LC50 values determined for 24, 48, 72 and 96 hours for each compound. These LC50 values demonstrate that NaPCP is more deleterious than HgCl2. Also, it shows that both these molluscicides lack specificity and can pose a threat to environmental health. (Deal-EIS)
W80-02421

SOURCE OF MERCURY IN FISH IN NEW IMPOUNDMENTS,
Southern Illinois Univ., Carbondale. Dept. of Chemistry and Biochemistry.
J. A. Cox, J. Carnahan, J. DiNunzio, J. McCoy, and J. Meister.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 779-783, 1979. 2 Tab, 9 Ref.

Descriptors: *Mercury, *Path of pollutants, *Reservoirs, Heavy metals, Absorption, Fish physiology, Food chains, Bass, Sunfishes, Bottom sediments, Water pollution sources, Impoundments, Illinois, Cedar Lake, *Tissue analysis, *Biomagnification.

That high levels of mercury are often found in fish flesh in new impoundments is well-known; however, the source(s) of the mercury is typically not identified. Fish from a recently constructed reservoir were analyzed for mercury content using flameless atomic absorption spectrometry. As expected, species which were high in the food chain contained more mercury as a result of biomagnification through the food chain. The data indicate that the mercury entered the food chain from the soil which was inundated when the impoundment was constructed. A subsequent conclusion is that within a few years the mercury levels in fish should be normal. (Deal-EIS)
W80-02424

UTILIZATION OF BACTERIAL COLONY COUNTERS TO COUNT EARLY INSTAR WATER FLEAS (DAPHNIA MAGNA),
EG and G Bionomics, Wareham, MA. Aquatic Toxicology Lab.
G. A. LeBlanc.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 837-839, 1979. 1 Tab, 7 Ref.

Descriptors: *Research equipment, *Analytical techniques, *Daphnia, Laboratory equipment, Bioassay, Testing procedures, *Methodology, Aquatic populations, Evaluation, Growth stages.

Chronic toxicity studies utilizing the water flea have proven to be a valuable tool in estimating safe levels of potential toxicants in the aquatic environment. Due to the small size of the animals and the large number of animals which must be counted (up to 70,000 per test), this task can be very tedious with a high error potential if counting is done manually. Experiments were performed to evaluate the accuracy of a bacterial colony counter adapted to count early instar Daphnia magna. Accuracy was tested by multiple manual counting of test groups. The error potential of the automatic counter was under 2% for small groups, but increased with the size of the group. It was concluded that this error potential was smaller than that of the manual counting method in addition to taking half the time required in manual counting. It was recommended that small groups (less than 125) be used to minimize error. (Deal-EIS)
W80-02426

HEAVY METAL CONTENTS IN COASTAL WATER FISHES OF WEST MALAYSIA,
Nebraska Univ., Lincoln. Dept. of Food Science and Technology.
A. S. Babji, M. S. Embong, and W. W. Woon.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 830-836, 1979. 4 Tab, 23 Ref.

Descriptors: *Baseline studies, *Heavy metals, *Commercial fish, Pollutant identification, *Mercury, *Lead, *Zinc, *Cadmium, Path of pollutants, Industrial wastes, Chemical analysis, Public health, *Malaysia, *Tissue analysis, *Bioaccumulation.

This study was aimed at examining the contents of zinc, lead, cadmium, and mercury in fishes caught around the coastal waters of West Malaysia. The areas chosen differ in hinterland industrial development, consisting mainly of ports, shipping, oil refineries, and miscellaneous small manufacturing industries in the west and south and basically non-industrialized areas in the north and east of peninsular Malaysia. The overall means for cadmium range from 0.03-0.05 ppm; lead, 0.21-0.32 ppm; zinc, 2.3-6.5 ppm; and mercury, 0.08-0.10 ppm. All these levels were found to be below the maximum permissible limits set by the U. S. Food and Drug Administration. Location of sampling was found to play a role in heavy metal accumulation. Concentrations were higher in industrial regions as compared to agricultural areas. Significant variance in heavy metal content between fish species was noted for all metals except mercury. (Deal-EIS)
W80-02427

AN ANALYSIS OF FEEDING RELATIONSHIPS AMONG ESTUARINE FISHES RAISED IN POLYCULTURE IN PONDS RECEIVING THERMAL EFFLUENTS,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
M. R. Branch, and K. Strawn.
In: Power Plant Waste Heat Utilization in Aquaculture. B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian, C. R. Guerra and C. A. Stephens, Editors Allanhald and Osmun & Co., Montclair, New Jersey, p 29-41, 1979. 3 Fig, 2 Tab, 23 Ref.

Descriptors: *Fish farming, *Thermal pollution, *Powerplants, Aquiculture, Productivity, Growth rates, Commercial fish, Mullets, Drums, Fish management, Fish diets, Heated water, Cooling water, Water temperature, *Atlantic croaker, *Micropogon.

Three species of estuarine fish were raised in 0.1 ha ponds from August 1976 to May 1977. These ponds received a continuous flow of thermal effluents. Black drum, Pogonias cromis, and Atlantic croaker, Micropogon undulatus, were each raised in polyculture with striped mullet, Mugil cephalus. All three species were also maintained in monoculture. All fish were fed a supplemental ration at rates based on body weight and their observed utilization of feed. Survival, growth rates, food conversion, and competition values were computed. At termination of this study, the size and composition of naturally occurring populations of macrofauna, other than stocked species, were estimated for each pond. These estimates along with other growth data were used to analyze the feeding relationships which occurred among species in polyculture and to determine whether such relationships might prove beneficial in terms of growth and production. Growth of all species was improved in polyculture. Increased growth among fishes in polyculture was attributed to more complete utilization of natural food resources and a facilitated feeding response due to fish-to-fish attraction. Food conversion values also indicated increased consumption of natural foods by fish maintained in polyculture. Flow of heated water into these ponds during the cool season was a critical factor governing the growth of these fish. (Deal-EIS)
W80-02433

PILOT-SCALE SYSTEMS FOR THE CULTURE OF LOBSTERS IN THERMAL EFFLUENT,
San Diego State Univ., CA. Dept. of Biology.
J. M. Carlberg, J. C. Van Olst, and R. F. Ford.
In: Power Plant Waste Heat Utilization in Aquaculture. B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian, C. R. Guerra and C. A. Stephens, Editors, Allanhald and Osmun & Co., Montclair, New Jersey, p 69-78, 1979. 3 Fig, 11 Ref.

Descriptors: *Lobsters, *Aquiculture, *Thermal pollution, Heated water, Powerplants, Cooling water, Water temperature, Growth rates, Productivity, Toxicity, Mortality, Cost analysis, Heavy metals, Animal metabolism, Commercial shellfish.

This paper reviews the recent progress made in the San Diego University aquaculture program to develop commercially viable lobster culture in the United States. It summarizes work on the evaluation of the use of thermal effluent in the culture of the American lobster, Homarus americanus, and on the development of techniques for the culture of this species. Studies show that there appear to be no detrimental effects of potentially toxic chemicals, such as heavy metals or chlorinated hydrocarbons, in the use of thermal effluents in lobster culture. The levels of excretion and acute toxicity for the metabolites secreted by the culture organism have been determined and can now be controlled. The influence of constant and fluctuating elevated temperatures on growth and survival has been measured. The development of prototype production modules for the intensive individual rearing of lobsters is discussed. Related problems on broodstock development, communal rearing of juvenile stages, formulation of artificial pelletized diets, and estimates of production costs are presented. (Deal-EIS)
W80-02434

BIOLOGICAL AND RADIOLOGICAL ANALYSIS OF THE POTENTIAL OF NUCLEAR POWER PLANT EFFLUENT WATERS FOR SHELLFISH CULTURE,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
R. A. Lutz, and C. T. Hess.
In: Power Plant Waste Heat Utilization in Aquaculture, B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian, C. R. Guerra and C. A. Stephens, Editors, Allanhald and Osmun & Co., Montclair, New Jersey, p 109-138, 1979. 18 Fig, 4 Tab, 53 Ref.

Descriptors: *Shellfish farming, *Thermal pollution, *Powerplants, Mussels, Oysters, Commercial

Shellfish, Heated water, Cooling waters, Water temperature, Nuclear powerplants, Growth rates, Mortality, Radioisotopes, Absorption, Path of pollutants, Radiochemical analysis, Cobalt radioisotopes, *Tissue analysis, *Bioaccumulation, *Depuration, *Manganese radioisotopes, *Cesium radioisotopes.

Over the past five years, two species of commercially important shellfish (Mytilus edulis L. and Crassostrea virginica Gmelin) have been experimentally rafted at varying distances from the heated effluent waters of a nuclear power reactor. Two distinct effluent system designs, surface outflow (1973 to May 1975) and subsurface diffuser (July 1975 to 1978), are compared and contrasted with regard to their potential for cultivation of these bivalves. Interspecific comparisons are made of growth and survival, as well as the uptake and retention of gamma-ray-emitting radionuclides by these filter-feeding molluscs. From 1973 through 1975, cumulative shell growth of Crassostrea virginica was generally negatively correlated with distance from the heated outflow, reaching a minimum at the control site in an adjacent estuary. Oyster mortalities at all experimental sites were less than 5% and not significantly different from those encountered at the control site. In contrast, growth rates and survival of Mytilus edulis from 1973 through 1974 were generally positively correlated with linear distance from the effluent, reaching maximum values at two control localities within adjacent estuaries. After installation of the diffuser system, growth and survival of Mytilus at all experimental sites, while significantly greater than that encountered directly in outflow waters during previous years, remained low relative to control stations. (Deal-EIS)
W80-02436

DISEASONAL WASTE HEAT AQUACULTURE: A THREE-YEAR REVIEW,
Trenton State Coll., NJ. Dept. of Biology.
A. F. Eble, N. E. Stolpe, M. C. Evans, N. DeBlois, and T. Passanza.
In: Power Plant Waste Heat Utilization in Aquaculture. B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian, C. R. Guerra and C. A. Stephens, Editors, Allanhald and Osmun & Co., Montclair, New Jersey, p 139-158, 1979. 10 Fig, 9 Tab, 25 Ref.

Descriptors: *Aquiculture, *Powerplants, *Thermal pollution, Heated water, Water temperature, Cooling waters, Rainbow trout, Eels, Growth rates, Fish farming, Shellfish farming, Productivity, Seasonal, *Prawns, *Macrobrachium.

A research team was formed in 1974 to investigate the potential of culturing animals in the waste heat effluents of a fossil fuel electric generating station in Trenton, N.J. The research mission was to explore the biological feasibility and economic potential of culturing to market size Macrobrachium rosenbergii during one-half of the year (May to October) and rainbow trout for the other six months. Further, other species were to be evaluated as possible additions to the number of cultured animals. Macrobrachium rosenbergii. In order to increase total surface area of ponds, netting was draped in 'M'-shaped configurations approximately 30cm apart. Regardless of stocking densities (19 to 27 prawns/sq m)., harvest yields ranged from 11 to 16 animals/sq m (20g average size): calculated solely on bottom surface area, harvest yields were 32 sq m, which is three times more productive than present harvest yields using extensive farming techniques. Salmo gairdneri. Our aquaculture system previously had to employ intermittent flows to raceways due to power plant chlorination cycles; this resulted in low dissolved oxygen and high ammonia levels during periods of pump shutdown. A new method has been designed and is presently operating that utilizes a reservoir through which water can be recirculated to bypass power plant discharge water when chlorine programs are operating. (Deal-EIS)
W80-02437

ON FISH CULTURE AND ON THE USE OF HEATED EFFLUENTS IN POLAND,
Instytut Rybactwa Srodladowego, Zabieniec (Poland). Pond and River Dept.
T. Backiel.
In: Power Plant Waste Heat Utilization in Aquaculture. B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian, C. R. Guerra and C. A. Stephens, Editors, Allanhald and Osmun and Co., Montclair, New Jersey, p 215-230, 1979. 8 Fig, 2 Tab, 19 Ref.

Descriptors: *Fish farming, *Thermal pollution, *Powerplants, Aquiculture, Heated water, Cooling water, Carp, Salmonids, Pikes, Freshwater fish, Fish management, Commercial fish, *Poland.

This paper presents information on cultivated fishes and their relative significance in Polish inland fisheries. The main cultivation systems and some recent technical innovations are discussed. Carp is currently the most important fish cultivated in Poland, comprising 45% of the total market. Less frequently cultivated species include pikes and various salmonids. Three concepts on the use of heated effluents from power stations are exemplified: a system of production of cold- and warm-water fishes at one farm; the utilization of heated lake water for fish production; and warm-water cage culture. (Deal-EIS)
W80-02438

WASTE HEAT AQUACULTURE IN THE UNITED KINGDOM--A GENERAL REVIEW AND PARTICULARS OF MARINE FARM LTD., HINKLEY POINT, BRIDGWATER, SOMERSET, ENGLAND,
Marine Farm Ltd., Bridgewater (England).
M. V. Ingram.
In: Power Plant Waste Heat Utilization in Aquaculture. B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian., C. R. Guerra and C. A. Stephens, Editors, Allanhald and Osmun and Co., Montclair, New Jersey, p 231-234, 1979. 1 Tab.

Descriptors: *Aquiculture, *Heated water, *Nuclear powerplants, Powerplants, Thermal pollution, Cooling waters, Fish farming, Eels, Shellfish farming, Oysters, Commercial shellfish, Commercial fish.

The current state of various warm-water effluent fish farm projects in the United Kingdom are reviewed. Special reference is made to the efforts of Marine Farm Ltd. at the Hinkley Point nuclear powerplant complex. Here heated effluent is used in the culturing of eels from elvers and oyster seed from spat. Various technical problems encountered in the culture system are discussed and remedies presented. (Deal-EIS)
W80-02439

DIRECT USE OF COOLING AND BLOW-DOWN WATER FOR INTENSIVE FISH FARMING RESULTS OBTAINED IN A PILOT FACILITY AT THE NIEDERAUSSEM POWER PLANT,
Rheinisch-Westfaelishches Elektrizitaetswerk A.G., Essen (Germany, F.R.). Abt Anwendungstechnik.
K. Blank.
In: Power Plant Waste Heat Utilization in Aquaculture. B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian, C. R. Guerra and C. A. Stephens, Editors, Allanhald and Osmun and Co., Montclair, New Jersey, p 235-242, 1979. 7 Fig.

Descriptors: *Fish farming, *Heated water, *Powerplants, Aquiculture, Water temperature, Carp, Eels, Cooling waters, Thermal pollution, Fish management, Growth rates, Productivity, Fish diseases.

RWE is the largest private-sector power supply utility in West Germany and generates 35% of the country's electricity needs. In 1974 it decided to examine the practical possibilities of using process water for the farming of freshwater fish. The results so far show that both the cooling water and the blow-down water from this lignite-fired power plant are suitable for fish culture. In both types of water the growth for carp was four times, and for eel five times, that in conventional fish culture. Stocking densities of 1:10 are attained for carp and 20 to 25 kg/sq m for eel. Industrial fish farming, which is in its early days in West Germany (two other facilities are operating on heated surface water), faces the following problems: (a) cleaning waste water economically for fish farming, (b) obtaining a season-independent fish stock, and (c) preventing disease in the fish. (Deal-EIS)
W80-02441

RELATIONSHIPS OF ACTIVITIES OF METAL-LIGAND SPECIES TO AQUATIC TOXICITY,
Minnesota, Univ.-Duluth. Dept. of Chemistry.
V. R. Magnuson, D. K. Harriss, M. S. Sun, D. K. Taylor, and G. E. Glass.
In: Chemical Modeling in Aqueous Systems, E. A. Jenne, Ed., American Chemical Society, Symposium Series, No 93, p 635-656, 1979. 2 Fig, 10 Tab, 15 Ref.

Descriptors: Metals, *Copper, Water pollution effects, *Toxicity, Bioassay, Laboratory tests, Methodology, Daphnia, Water quality, Chemical analysis, *Chemical properties, Chemical reactions, Metal-ligand species, Copper species, Chemical activity, Copper carbonate, Copper complexes, Free copper.

The use of factor analysis and multiple regression in determining relative toxicities of species is described. Procedures are illustrated using the data of Andrew, Biesinger and Glass from a study of toxicity of copper to Daphnia magna following a recalculation of the equilibrium speciation of copper. The results yield tentative conclusions that the carbonate copper complexes are not toxic, the anionic hydroxo copper complexes contribute 15-18% to the toxicity of copper, and that free copper and/or the neutral and/or cationic hydroxo copper complexes are responsible for 60-70% of the toxicity in this set of experiments. The limitations of this analysis are discussed and a set of experiments which should provide more definitive answers to the relative toxicity of these species is described. (Katz-EIS)
W80-02444

ENVIRONMENTAL EFFECTS OF OIL SHALE MINING AND PROCESSING PART III - THE WATER QUALITY OF PICEANCE CREEK, COLORADO, PRIOR TO OIL SHALE PROCESSING,
Colorado State Univ., Fort Collins. Dept. of Chemistry.
R. K. Skogerboe, C. S. Lavallee,, M. M. Miller, and D. L. Dick.
Environmental Protection Agency, Report EPA 600/3-79-055, May 1979. 59 p, 22 Fig, 7 Tab, 12 Ref, Append.

Descriptors: *Metals, *Oil, Mining, *Mineral industry, Monitoring, Water quality, Water chemistry, Colorado, Piceance Creek, Piceance Basin, Steward Creek, Black Sulphur Creek, Yellow Creek, *Oil shale, Dissolved solids, Manganese, Iron, Groundwater, Copper, Zinc, Arsenic, Selenium, Mercury.

Water quality data have been collected at seven sites along Piceance Creek and at one site each along Stewart, Black Sulphur, and Yellow Creeks in the Piceance Basin, Colorado, during 1975-1977. Piceance, Stewart, and Yellow Creeks may be perturbed by oil shale industry activities on the two tracts, C-a and C-b, currently under development. The preoperational water quality is generally poor due to higher levels of dissolved solids, manganese, and both dissolved and suspended iron. It further declines farther downstream primarily due to influxes from groundwater aquifers in contact with soluble mineral beds. The levels of aluminum, cadmium, chromium, lead, and boron were below the detection limits of the analysis method used. These were typically below the permissible levels set for aquatic life by factors of 5-10. The levels of copper, zinc, arsenic, selenium, and mercury were usually measurable but still below permissible. Equilibrium calculations indicate that the natural conditions along Piceance Creek--in particular the alkaline pH range (7.5-8.5) and high carbonate alkalinity (300-800 mg CaCO3/liter)-should limit the solubilities of most metals to levels below the standards for aquatic life. (Katz-EIS)

W80-02445

AN ASSESSMENT OF THE THERMAL EFFECTS ON STRIPED BASS LARVAE ENTRAINED IN THE HEATED DISCHARGE OF THE INDIAN POINT GENERATING FACILITIES UNITS 2 AND 3,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
H. H. Carter, R. E. Wilson, and G. Carroll.
Special Report 24, Reference 79-7, June 1979. 33 p, 21 Fig, 1 Tab, 21 Ref.

Descriptors: *Nuclear powerplants, *Heated water, *Toxicity, *Striped bass, Larval growth stage, Entrainment, Mathematical models, Cooling water, Thermal pollution, Water temperature, Mortality, Thermal stress, Estuaries, Lethal limit, New York, Hudson River.

In this report there is modelled the excess temperature and velocity fields associated with the heated discharge from a large generating station sited on a tidal estuary using the model, together with appropriate thermal resistance data, thermally induced mortality levels of striped bass post yolk sac larvae entrained in the thermal plume are evaluated. The model consists of separate near-field and far-field portions which were combined to form a complete-field model by vector addition of the velocity fields and by superposition of the excess temperature fields based on a simple mixing concept. By calculating and storing velocity and excess temperature fields appropriate to each of 20 different phases of the tide, a complete-field model followed, The thermal dose experienced by an assumed initial distribution of passive organisms where the receiving water velocities are time varying, such as occurs in a tidal estuary or coastal setting, as well as unidirectional is calculated. For this reason it is considered quasi-transient state. The model further suggests that the zone of influence or withdrawal of the intakes is limited to 20-30 meters in the lateral direction. (Deal-EIS)
W80-02446

NOTE ON RAPID AND SENSITIVE METHOD FOR THE DETERMINATION OF ANIONIC DETERGENTS IN NATURAL WATERS, AT THE PPB LEVEL,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
For primary bibliographic entry see Field 5C.
W80-02465

GROWTH RESPONSE OF ANABAENA FLOS-AQUAE (LYNGB.) DE BREBISSON IN WATERS COLLECTED FROM LONG LAKE RESERVOIR, WASHINGTON,
Corvallis Environmental Research Lab., OR.
T. Shiroyama, W. E. Miller, J. C. Greene, and C. Shigihara.
In: Proceedings of the Symposium on Terrestial and Aquatic Ecological Studies of the Northwest, Eastern Washington State College, Cheney, Washington, March 26-27, 1976, EWSC Press, Cheney, p 267-275, 1976. 4 Fig, 1 Tab, 11 Ref.

Descriptors: Algae, *Phytoplankton, *Nutrients, Washington, Long Lake, Spokane River, Long Lake Reservoir, Bioassay, Anabaena, *Phosphorous compounds, Plant growth, Plant physiology, Zinc, Orthophosphates, Laboratory tests, Domestic wastes, Chelating agents, EDTA.

Effluent from the Spokane primary sewage treatment plant and heavy metal contaminants from the Coeur d'Alene Lake watershed have been major water quality problems in the Spokane River and Long Lake Reservoir. Using the Algal Assay Procedure: Bottle Test, waters collected from the reservoir were used to measure the growth response of a filamentous nitrogen-fixing blue-green alga, Anabaena flos-aquae. Predicted algal yields based on chemical analysis of the test waters for orthophosphorus, indicated that only 28% of the Anabaena cultures produced optimal growth. There was a substantial increase in response when the test waters were spiked with an EDTA chelator-thus indicating the presence of heavy metals. The influences of heavy metals were more prominent during the high flows of spring and fall. When the heavy metal toxicity was overcome by chelation, phosphorus was found to be the primary growth limiting nutrient for support of Anabaena flos-aquae. (Katz-EIS)
W80-02475

BIOASSAYS RELATED TO THE EFFECTS OF COAL STRIP MINING AND ENERGY CONVERSION ON THE AQUATIC MICROFLORA,
Montana State Univ., Bozeman. Dept. of Microbiology.
G. Olson, S. Turbak, and G. McFeters.
In: Proceedings of the Symposium on Terrestial and Aquatic Ecological Studies of the Northwest. Eastern Washington State College, Cheney, Washington, March 26-27, 1976, EWSC Press, Cheney, p 227-283, 1976. 2 Fig, 2 Ref.

Descriptors: *Bioassay, *Algae, *Copper, Laboratory test, *Toxicity, Coal mines, Coal mine wastes, Strip mines, *Strip mine Wastes, Montana, Decker, Colstrip, Algal assay procedure, Selerastrum, Metals, Phosphorous, Coal, Leachates.

The practice of strip mining for coal has been intensified in many Western states recently. Specific microbial bioassays for the detection of inhibitory or stimulatory compounds which may be present in the aquatic environment due to coal mining and related energy conversion activities were developed. The waters under investigation are located in the Decker and Colstrip regions of southeastern Montana. Results from the Algal Assay Procedure: Bottle Test (AAP) have indicated that the surface waters studied at Decker are primarily phosphorus limited. Our results have also shown no heavy metal toxicity or trace element deficiency in these waters at the present time. We are currently using microorganisms isolated from waters in the affected areas to test coal leachates for presence of possible toxic materials in addition to monitoring the surface waters in the affected areas using the AAP. The green alga, Selenastrum capricornutum Printz, although not indigenous to these areas, shows potential for use as a bioassay organism. In an experiment with copper, for example, 0.0 to 0.4 ppm (of Cu++ added as CuS04. 5H20) added to the growth medium resulted in a steady decline in growth rate. (Deal-EIS)
W80-02476

METABOLIC ACTIVITY OF BACTERIA IN THE RIVER DANUBE IN A YEAR CYCLE,
Institute of Experimental Biology and Ecology, Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 5C.
W80-02504

ESCHERICHIA COLI BACTERIOPHAGES AS TRACERS IN WATER MOVEMENT STUDIES,
Helsinki Univ. (Finland). Dept. of Microbiology.
K. Kinnunen, S. Niemela, and M. Poikolainen.
In: Proceedings: Congress in Denmark, 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2272-2277. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Tracers, *Marking techniques, *E. coli, *Discharge measurement, *Discharge(Water), *River flow, Indicators, Analytical techniques, Movement, Tracking techniques, Bioindicators, Flow, Velocity, Chezy equation, Kymi River(Finland), Vantaa River(Finland), Time, Distance, Bacteria, Rivers, Microbiology, Sewage bacteria.

Bacteriophagic tracers are practical in studying river water flows; in Finnish experiments the largest tracer volume was 5000 ml, longest distance measure, 62 km, and greatest discharge 574 cu m/sec. Phage tracers are environmentally harmless; this is not true of radioactive isotopes. Due to phage host specificity, several different phages can be used simultaneously as tracers, permitting travel velocity studies of entire water courses. The greatest disadvantage of this method is that separate phage samples must be taken and cultivated in the laboratory. However, results can be read 4-6 hours after cultivating which is quick compared to other microbiological tracer methods. Marking studies on water travel speed in the Kymi River occurred in 1968, 1970, and 1975; discharge varied 258-574 cu m/sec. Nearly perfect linear correlation (r=0.9997) observed between Kymi discharge and velocity is taken as proof of the value of phage methods. In the Vantaa River, four different phages were used simultaneously in a marking experiment. Tracer waves reached the sampling site partly overlapping, but they were identified from the same samples through cultivation. (Danovich-Wisconsin)
W80-02509

CARBON ANALYSIS FOR THE DETERMINATION OF INDIVIDUAL BIOMASSES OF PLANKTONIC ANIMALS,
Helsinki Univ., Lammi (Finland). Lammi Biological Station.
For primary bibliographic entry see Field 5C.
W80-02551

TRACE METAL ION FILTRATION LOSSES AT PH 5 AND 7,
New Hampshire Univ., Durham. Dept. of Chemistry.
R. E. Truitt, and J. H. Weber.
Analytical Chemistry, Vol 51, No 12, p 2057-2059, October 1979. 2 Tab, 22 Ref. OWRT B-004-NH(2), 14-34-0001-8132.

Descriptors: *Copper, *Ion movement, *Filtration, *Membranes, *Ion transport, Hydrogen ion concentration, Separation techniques, Leaching, Trace elements, *Polycarbonate filter supports, *Glass filter supports, *Nucleopore polycarbonate membrane, *Cellulose triacetate membrane, *Copper filtration losses, Metal ion concentrations, Ion filtration losses.

The purpose of this experiment was to point out changes in metal ion concentrations that occur from filtering solutions with pH and metal ion levels similar to many natural water systems. Acetate buffer or phosphate buffer was filtered using cellulose acetate or polycarbonate membranes on polycarbonate support. Slight contaminations of Cu2+ and Pb2+ occurred. Cu2+ and Pb2+ leached from both membranes at pH 5 and 7. Percentage Cu2+ losses were then determined as a function of filter support, filter membrane and pH and greatest losses occurred using glass support. Losses with polycarbonate support were insignificant except for filtering with a cellulose acetate membrane. Cu2+ losses with polycarbonate membranes were 35% whereas losses with cellulose acetate membranes were 18%. Average Cu2+ loss of glass support/polycarbonate membrane and polycarbonate support/cellulose acetate membrane combinations was 39% compared to 14% for glass/cellulose acetate and polycarbonate/polycarbonate combinations. Varying pH had little effect on Cu2+ losses.
W80-02600

EPIPHYTIC DIATOMS OF THREE SEAGRASS SPECIES IN MISSISSIPPI SOUND,
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
M. J. Sullivan.
Bulletin of Marine Science, Vol 29, No 4, 459-464, October 1979. 3 Tab, 11 Ref. OWRT A-114-MISS(2), 14-34-0001-8026.

Descriptors: *Diatoms, *Rooted aquatic plants, *Sessile algae, *Biological communities, Ecological distribution, Biogeography, Marine algae, Submerged plants, Aquatic habitats, Mississippi, *Scanning electron microscope, *Epiphytic algae, *Seagrasses, Community diversity, Horn Island(Miss Sound), Halodule, Cymodocea(=Syringodium), Thalassia.

Epiphytic diatoms were collected on 20 July 1977 from the leaves of three seagrass species (Halodule beaudettei, Cymodocea filiforme, and Thalassia testudinum) in Mississippi Sound, U.S.A. Examination of cleaned material under the light and scanning electron microscope revealed a total of 45

diatom taxa epiphytic on the three seagrasses. The four most abundant diatoms were Fragilaria hyalina, Mastogloia pusilla, Licmophora cf. debilis, and Opephora pacifica. Except for the rare taxa, the taxonomic composition was identical regardless of the seagrass species examined. Based on counts of 1,000 valves, values of community diversity statistics (H', S, and R') were virtually identical for the three epiphytic diatom samples. Use of a selected similarity index (SIMI) revealed that any two samples shared between 82 and 88% of the maximum similarity possible. Therefore, the available taxonomic and structural information indicated that the above three seagrasses supported a single, nearly homogeneous epiphytic diatom community at the time of sampling and in the locality sampled. (Sullivan-Mississippi)
W80-02602

ASSOCIATION OF HYDROPHOBIC ORGANIC COMPOUNDS WITH DISSOLVED ORGANIC MATTER IN AQUATIC SYSTEMS,
Wisconsin Univ.-Madison. Water Chemistry Program.
J. P. Hassett, and M. A. Anderson.
Environmental Science and Technology, Vol 13, No 12, p 1526-1529, December 1979. 6 Fig, 1 Tab, 11 Ref. EPA R00514201.

Descriptors: *Pollutant identification, *Testing procedures, Methodology, *Wisconsin, *Aquatic environment, Organic compounds, Organic matter, Polychlorinated biphenyls, Chromatography, Rivers, Cholesterol, Water, Ultraviolet radiation, *Menomonee River(WI).

Radiolabeled cholesterol added to water samples was recovered less efficiently from river water than from distrilled water by solvent extraction. However, if organic matter in river water was destroyed with UV radiation prior to cholesterol addition, recovery was equivalent to that from distilled water. This demonstrated that cholesterol could be bound by dissolved organic matter and stabilized in the aqueous phase. Water samples containing radiolaveled cholesterol or the PCB isomer 2,2',5,5' -tetrachlorobiphenyl were fractionated by gel permeation chromatography. Results indicated that these compounds were associated with high molecular weight organic matter present in the samples. (Humphreys-ISWS)
W80-02681

AN EVALUATION OF COLUMN CHROMATOGRAPHY AND FLAMELESS ATOMIC ABSORPTION SPECTROPHOTOMETRY FOR ARSENIC SPECIATION AS APPLIED TO AQUATIC SYSTEMS,
Wisconson Univ.-Madison. Water Chemistry Program.
D. G. Iverson, M. A. Anderson, T. R. Holm, and R. R. Stanforth.
Environmental Science and Technology, Vol 13, No 12, p 1491-1494, December 1979. 1 Fig, 1 Tab, 31 Ref. USEPA R-804-881, DACW23-77-C-0046.

Descriptors: *Testing procedures, *Arsenic, *Water analysis, *Analytical techniques, Speciation, Methodology, Spectrophotometry, Chromatography, Laboratory tests, Chemical analysis, Sampling, Water sampling, Aquatic environment, Rivers, Pore water, Atomic absorption,.

Flameless atomic absorption (FAA) and chromatographic methods for routine analysis and speciation of environmental arsenic were presented. Matrix modification with Ni(NO3)2 was used with FAA to measure As concentrations in river water and sediment samples. Detection limits were 2 micrograms of As/L and FAA response for As concentration was independent of As species. Inorganic As (As(V) and As(III)), mono-methylarsonic acid (MMAA), and dimethylarsinic acid (DMAA) were separated on cation exchange columns and detected by FAA. These methods were applied to samples collected from the Menominee River, Wisconsin, where As contamination has resulted in As levels ranging from 1 to 1000 micrograms/L in river water, from 10 to 7000 mg/L in sediment pore water, and from 4 to 30 mg/g in sediment solids. Field data were presented to illustrate the application of the procedures. Sampling methods and preparation were included. (Humphreys-ISWS)
W80-02682

ASSIMILATIVE CAPACITY OF SMALL STREAMS,
Parsons, Brinckerhoff, Quade, and Douglas, Inc., New York.
For primary bibliographic entry see Field 5B.
W80-02693

5B. Sources Of Pollution

WATER QUALITY EFFECTS OF LEAD FROM RECREATIONAL BOATING,
California State Coll., Stanislaus, Turlock. Dept. of Chemistry.
J. E. Byrd, and M. J. Perona.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127236, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis Technical Completion Report, December 1979, 40 p, 13 Fig, 5 Tab, (California Water Resources Center Project UCAL-WRC-W-552). OWRT-A-071-CAL(1).

Descriptors: *Water quality, *Lead, *Boating, *Recreation, *Pollution, *Lakes, Heavy metals, Natural streams, California.

The temporal and spatial variations in the lead concentration of a fresh water-recreational lake were determined, and the results compared with daily records of lake volume, residence time and number of boats launched. In addition, laboratory studies were carried out to establish the influence of sediment-water interactions on the lead concentration of the lake water. The variation in the lead concentration in the main body of the lake was found to correlate with the lake volume. This fact, together with the laboratory studies and calculations based on a plug flow model, suggest that sediment-water interactions are significant in controlling the lead concentration in the main body of the lake. On the other hand, boating was found to be important in controlling the lead concentration in the boat dock area. This water is subjected to both poor mixing and heavy boat traffic. (Snyder-California)
W80-02403

THE SURVIVAL OF ENTERIC VIRUSES IN SEPTIC TANKS AND SEPTIC TANK DRAIN FIELDS,
New Mexico State Univ., Las Cruces. Dept. of Biology.
K. E. Hain, and R. T. O'Brien.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127251, Price codes: A05 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University, Report No 108, August 1979. 73 p, 14 Fig, 11 Tab, 55 Ref, Append. OWRT A-052-NMEX(6), 14-34-0001-9033.

Descriptors: *Septic tanks, *Water pollution sources, Groundwater movement, *Enteric virus, *Virus movement, *Virus persistance, *Drainfield soils, Poliovirus.

The persistence of enteric viruses in a functioning septic tank system was followed using poliovirus type I as a model. Poliovirus was incubated in dialysis membrane chambers suspended both in the chambers of a septic tank and in groundwater observation wells strategically placed in the adjacent drainfield. Poliovirus was also incubated, in situ, in the sandy loam drainfield soils to monitor virus movement and inactivation. Attempts were made to isolate indigenous enteric viruses from the septic tank and drainfield groundwater. Indigenous enteric viruses were regularly recovered from the septic tank. Seeded poliovirus type I survived in the septic tank environment long enough to enter the drainfield. Viruses introduced into the drainfield remained infective for extended periods and moved with groundwater flows. Poliovirus incubated in shallow groundwater was rapidly inactivated, but contact with soil seemed to have a protective effect. A consistent disagreement between the results from laboratory experiments and field studies was noted. The septic tank system used lay in the flood plain of the Rio Grande, within the Elephant Butte Irrigation District. Movement of indigenous enteric viruses through drainfield soils and into shallow groundwater during the initiation of irrigation-season river flows was reported. (Herman-New Mexico)
W80-02404

MATHEMATICAL MODEL OF HEAVY METAL TRANSFER AND TRANSPORT IN LAKE ERIE,
Bowling Green State Univ., OH. Dept. of Geology.
L. J. Walters Jr., and D. C. Drain.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127590, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Center, Ohio State University, Columbus. Project completion Report No 549x, August 1979, 141 p, 18 Fig, 7 Tab, 31 Ref, 3 Append. OWRT A-045-OHIO(1).

Descriptors: *Bottom sediments, *Deposition(Sediments), *Sediment transport, *Heavy metals, *Water pollution sources, *Lake Erie, Sedimentation rates, Suspended load, Path of pollutants, Mathematical models, *Mercury, *Chromium, *Nickel.

Numerical integration of mathematical functions representing the concentration of mercury, chromium and nickel in Lake Erie sediments indicate that 3.3 x 10 to the 5th power kg Hg, 1.8 x 10 to the 7th power kg Cr, and 1.2 x 10 to the 7th power kg Ni have been added to the sediments through man's activities. Most of the mercury, chromium and nickel are contained in the sediments of western Lake Erie. A mathematical model of sediment transport in Lake Erie shows that most of the heavy metals in western Lake Erie sediments probably originated from the Detroit metropolitan area and was input via the Detroit River. The sediment dispersal patterns are as follows: (1) the Detroit River sediment spreads southeastward over most of the western basin, (2) the Maumee River sediment is held within 15 miles of the Ohio shore, and (3) the Cuyahoga River sediment travels northeastward along the south shore of the lake. Attempts to model the transfer and transport of mercury within the ecosystem resulted in partial success. Very little transfer results between the sediments and other phases within the system. In contrast the exchange of mercury between the benthic organisms and other trophic and abiotic levels is very rapid.
W80-02407

POLIOVIRUS TYPE I REMOVAL BY MONTMORILLONITE CLAY,
California Univ., Los Angeles. Dept. of Chemical, Nuclear and Thermal Engineering.
G. L. Meronek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127210, Price codes: A03 in paper copy, A01 in microfiche. MS Thesis, 1978, 47 p, 9 Fig, 6 Tab, 2 Append. (California Water Resources Center Project UCAL-WRC-W-523). OWRT B-184-CAL(4).

Descriptors: *Viruses, *Montmorillonite, *Clays, *Waste water(Pollution), *Waste water disposal, Water pollution, Pollutants.

This study arises from the problem of underground water contamination by viruses in percolating wastewater or eluted from landspread sludge. Since current water treatment facilities are unable to completely remove viruses from wastestreams, the task of virus removal by soils is required. At present the mechanism by which viruses are removed by soils is unknown. This study attempts to obtain a better understanding of virus transport through soil beds by looking at the adsorption isotherm of poliovirus to montmorillonite clay. Clay was chosen as the adsorbent because of its extremely large surface area and because the per-

cent of clay in soil stands out as the most useful indicator of contaminant soil retention capability. The removal of poliovirus by montmorillonite clay was found to conform to a modified Freundlich isotherm. It was determined however that saturation of the clay particles was not reached so that a complete isotherm was not attained. Virus removal was found to depend on particle size and may be caused by association of the virions with aggregated clay particles. (Snyder-Cal)
W80-02408

TRACE METAL CONCENTRATIONS IN SELECTED BIOLOGICAL, SEDIMENT, AND WATER COLUMN SAMPLES IN A NORTHERN NEW ENGLAND RIVER,
Academy of Natural Sciences Philadelphia, PA. Div. of Limnology and Ecology.
For primary bibliographic entry see Field 5A.
W80-02417

EFFECT OF MERCURY ON THE MORPHOLOGY OF ERYTHROCYTES IN ANABAS SCANDENS,
Berhampur Univ., Orissa (India). Lab. of Environmental Toxicology.
A. K. Panigrahi, and B. N. Misra.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 784-787, 1979. 4 Fig, 16 Ref.

Descriptors: *Mercury, *Toxicity, *Fish physiology, Mode of action, Biological membranes, Heavy metals, Osmotic pressure, Freshwater fish, Cytological studies, Membrane processes, *Blood chemistry, *Red blood cells, *Anabas, Erythrocytes.

The purpose of this investigation was to study the effect of inorganic mercury on the morphology of erythrocytes in a freshwater fish, Anabas scandens. Fish were exposed to 0.5 mg/L of mercury as mercuric nitrate for 35 days. An enlargement of red blood cells (RBC) was observed within 7 days of exposure. After 7 days, finger-shaped proliferations were marked in the neutrophilic granulocytes of exposed fishes. Vacuoles were seen in the RBCs. Beak-like structures appeared on the RBCs after 14 days of exposure. Rupturing of RBC membrane after 28 days exposure was noticed, and in some cells disintegration of the nucleus and cell membrane was apparent. After 35 days exposure complete hemolysis and disappearance of cell membrane was seen. This affect in part explains the anemia associated with certain heavy metal poisoning. (Deal-EIS)
W80-02423

SOURCE OF MERCURY IN FISH IN NEW IMPOUNDMENTS,
Southern Illinois Univ., Carbondale. Dept. of Chemistry and Biochemistry.
For primary bibliographic entry see Field 5A.
W80-02424

HEAVY METAL CONTENTS IN COASTAL WATER FISHES OF WEST MALAYSIA,
Nebraska Univ., Lincoln. Dept. of Food Science and Technology.
For primary bibliographic entry see Field 5A.
W80-02427

MODIFICATIONS OF AN EXPERIMENTALLY POLLUTED ECOSYSTEM IN THE LAGOON OF STRUNJAN, NORTH ADRIATIC,
Marine Biological Station, Portoroz (Yugoslavia).
A. Malej, A. Avcin, J. Faganeli, N. Fanuko, and M. Lenarcic.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkee, p 423-429, 1979. 3 Fig.

Descriptors: *Biological communities, *Water quality, *Sewage effluents, Benthic flora, Benthic fauna, Dominant organisms, Lagoons, Phytoplankton, Zooplankton, Water chemistry, Metals, Water pollution effects, Aquatic algae, Eutrophication, Adriatic Sea, Lagoon of Strunjan.

In order to ascertain whether changes in the marine environment and their communities were due to the effects of pollution or natural fluctuations, the experimental pollution of a lagoon was studied. Sewage wastes of known quantity and chemical composition were released daily into the lagoon and the changes in numerous environmental parameters were recorded. Significant changes were noted in all physical and chemical parameters (e.g., temperature, pH, nutrients, DO, BOD, metals, etc.). A large bloom of nitrophilic algae created temporary anaerobic conditions and altered the normal annual plant succession. Phytoplankton biomass and abundance were reduced. Changes were also noted in zooplankton and bacteria communities. (Deal-EIS)
W80-02432

PILOT-SCALE SYSTEMS FOR THE CULTURE OF LOBSTERS IN THERMAL EFFLUENT,
San Diego State Univ., CA. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-02434

DETERMINATION OF SALINITY SOURCES IN WATER RESOURCES OF KANSAS BY MINOR ALKALI METAL AND HALIDE CHEMISTRY,
Kansas Water Resources Research Inst., Manhattan.
D. O. Whittemore, and L. M. Pollock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-128911, Price codes: A03 in paper copy, A01 in microfiche. Contribution No 208, October 1979. 28 p, 4 Fig, 10 Tab, 15 Ref. OWRT A-089-KAN (1), 14-34-0001-8018.

Descriptors: *Oil-field brines, *Saline formations, *Freshwater, *Kansas, *Saline water, Weight ratios, Chloride concentrations, Linear zone, Alkali metal.

Certain sources of brines contaminating freshwater resources in Kansas can be differentiated by their alkali metal and halide chemistry. Oil-field brines from Kansas generally have weight ratios of Na/Cl = 0.5 plus or minus 0.1, I/Cl >20 and Br/Cl >4. No noticeable trends in the constituent ratios was observed with increasing age of the producing strata. Saline formation waters usually have Na/Cl ratios of 0.65 plus or minus 0.03, I/Cl of <10, and Br/Cl <4. Most of these are probably derived from the solution of salt. Ratios involving lithium (Li/Cl, Br/Li, and Li/I) exhibited a wider range than for the above ratios, but varied much less for a particular brine within a particular geographic area. The constituent ratios Na/Cl, I/Cl, and Br/Cl thus appear to be the best for distinguishing among different types of brines, while ratios including lithium may prove helpful in further identifying local salinity sources. One of the clearest ways to differentiate among saline sources is by a graph of I/Cl versus chloride concentration. Fresh waters, saline brines from salt solution, and mixtures of these in Kansas plot as a linear zone about the line I/Cl = 103 (Cl)-0.5, where chloride concentration is in mg/l. Oil-field brines lie in a group at higher I/Cl and chloride concentration than this zone. Fresh waters contaminated by oil-field brines would be expected to plot in the gap between the linear zone and the oil brine group.
W80-02472

GROWTH RESPONSE OF ANABAENA FLOS-AQUAE (LYNGB.) DE BREBISSON IN WATERS COLLECTED FROM LONG LAKE RESERVOIR, WASHINGTON,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5A.
W80-02475

CHEMICAL QUALITY OF GROUND WATER ON CAPE COD, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
M. H. Frimpter, and F. B. Gay.
Geological Survey Water-Resources Investigations 79-65 (open-file report), 1979. 11 p, 6 Fig, 2 Plates, 2 Tab, 9 Ref.

Descriptors: *Water quality, *Groundwater, *Saline water intrusion, *Chemical analysis, *Water pollution sources, Sea water, Water wells, Pumping, Drawdown, Surface-Groundwater relationships, Groundwater recharge, Iron, Manganese, Nitrates, MUnicipal wastes, Insecticides, Hydrogen sulfide, Domestic wastes, Fertilizers, Massachusetts, Aquifer management, *Cape Cod.

Cape Cod is a 440 square mile hook-shaped peninsula which extends 40 miles into the Atlantic. Freshwater in Pleistocene sand and gravel deposits is the source of supply for nearly 100 municipal and thousands of private domestic wells. Most ground water on Cape Cod is of good chemical quality for drinking and other uses. It is characteristically low in dissolved solids and is soft. In 90 percent of the samples analyzed, dissolved solids were less than 100 mg/l (milligrams per liter) and pH was less than 7.0. Highway deicing salt, seawater flooding due to storms, and saltwater intrusion due to ground-water withdrawal are sources of sodium chloride contamination. Chloride concentrations have increased from 20 to 140 mg/l, owing to saltwater intrusion at Provincetown's wells in Truro. In Yarmouth, contaminated ground water near a salt-storage area contained as much as 1,800 mg/l chloride. Heavy metals, insecticides, and herbicides were not found at concentrations above the U.S. Environmental Protection Agency's recommended limits for public drinking-water supplies, but iron and manganese in some samples exceeded those limits. Ninety percent of 84 samples analyzed for nitrate reported as nitrogen contained less than 1.3 mg/l and 80 percent contained 0.5 mg/l or less of nitrate as nitrogen. Water containing nitrogen in excess of 0.5 mg/l has probably been affected by municipal or domestic sewage or fertilizer, and water with less than this amount may have been affected by them. (Woodard-USGS)
W80-02584

WATER-QUALITY INVESTIGATION OF THE FLAT BAYOU WATERSHED, JEFFERSON COUNTY, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb.
Availability: OFSS, USGS Box 25425, Denver CO 80225. Microfiche $3.50, papercopy $2.50. Geological Survey open-file report 79-1300, 1979. 19 p, 1 Fig, 3 Tab, 11 Ref.

Descriptors: *Water quality, *Surface waters, *Watershed management, *Water analysis, Chemical analysis, Land use, Topography, Water utilization, Groundwater resources, Hydrogeology, Aquifer characteristics, *Flat Bayou watershed(AR), Pre-soil conservation study.

The results of a 1-year study, in 1977-78, of surface-water quality in the Flat Bayou watershed, Jefferson County, Ark. are presented to document conditions before implementation of Soil Conservation Service programs. Analysis of samples collected at two sites showed that oxygen depletion, as low as 32 percent of saturation at times, and high concentrations of pesticides on the streambed were the most serious water-quality problems in the watershed. The pesticides aldrin, DDD, DDE, DDT, dieldrin, endrin, heptachlor epoxide, lindane, and toxaphene were found in samples of the bottom material. One sample of bottom material contained an unusually high toxaphene concentration of 160 micrograms per kilogram. (Woodard-USGS)
W80-02594

TRACING SUBTERRANEAN FLOW OF SEWAGE-PLANT EFFLUENT IN LOWER ORDOVICIAN DOLOMITE IN THE LEBANON AREA, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.; and Missouri Dept. of Natural Resources, Rolla Div. of Geology and Land Survey.
J. Skelton, and D. E. Miller.
Ground Water, Vol 17, No 5, p 476-486, September-October 1979. 4 Fig, 1 Tab, 6 Ref.

Descriptors: *Path of pollutants, *Subsurface flow, *Surface-groundwater relationships, *Sewage effluents, *Tracking techniques, Fluorescent dye, Rhodamine, Karst hydrology, Sinks, Faults(Geologic), Groundwater, Potentiometric level, Missouri, *Lebanon area(MO), Losing streams, Gaining streams.

In an area of faulted, cavernous, carbonate rocks of Ordovician age near Lebanon, Missouri, sewage-treatment-plant effluent was traced from Dry Auglaize Creek, a losing Ozark stream, to Sweet Blue and Hahatonka Springs in an adjacent basin. Rhodamine WT dye (20-percent solution) was used to trace the subsurface movement of the effluent. Activated charcoal packets and samples of water were collected at 10 sites where dye might be expected to reappear and at a control site outside the area. The leading edge of the dye reached Sweet Blue Spring, a distance of 22.5 kilometers from the injection point, 25 to 30 days after injection, and Hahatonka Spring, at a distance of 29.0 kilometers, 45 to 50 days after injection. The apparent underground travel rate, based on straight-line distances between injection and resurgence points, was 0.6 to 0.8 kilometers per day. (Woodard-USGS)
W80-02595

RECONNAISSANCE EVALUATION OF SURFACE-WATER QUALITY IN EAGLE, GRAND, JACKSON, PITKIN, ROUTT, AND SUMMIT COUNTIES, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
L. J. Britton.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, microfiche $3.50, paper copy $38.00. Geological Survey open-file report 79-420, April 1979. 285 p, 9 Fig, 41 Tab, 106 Ref.

Descriptors: *Water quality, *Colorado, *Streams, *Water polluton sources, *Evaluation, Streamflow, Water sampling, Chemical analysis, Chemical properties, Physical properties, Biological communities, *Northwest Colorado, Eagle County(CO), Grand County(CO), Jackson County(CO), Pitkin County(CO), Routt county(CO), Summit County(CO).

Water-quality data were collected from streams in a six-county area in northwest Colorado to determine if the streams were polluted and, if so, to determine the sources of the pollution. Eighty-three stream sites were selected for sampling in Eagle, Grand, Jackson, Pitkin, Routt, and Summit Counties. A summary of data collected prior to this study, results of current chemical and biological sampling, and needs for future water-quality monitoring are reported for each county. Data collected at selected sites included temperature, pH, specific conductance, dissolved oxygen, and stream discharge. Chemical data collected included nutrients, inorganics, organics, and trace elements. Biological data collected included counts and species composition of total and fecal-coliform bacteria, fecal-streptococcus bacteria, benthic invertebrates, and phytoplankton. Most of the sites were sampled three times: in April-June 1976, August 1976, and January 1977. (Woodard-USGS)
W80-02597

ENVIRONMENTAL POLLUTION FROM HIGHWAY DEICING COMPOUNDS,
Maine Univ. at Orono.
For primary bibliographic entry see Field 5C.
W80-02657

ACID PRECIPITATION: MEASUREMENT OF PH AND ACIDITY,
Virginia Univ., Charlottesville, Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2K.
W80-02667

ACIDIFICATION AND OTHER CHEMICAL CHANGES IN HALIFAX COUNTY LAKES AFTER 21 YEARS,
Fisheries and Marine Service, Halifax (Nova Scotia).
For primary bibliographic entry see Field 2K.
W80-02668

WATER AND NUTRIENT TRANSPORT VIA GROUNDWATER FROM WARD VALLEY INTO LAKE TAHOE,
California Univ., Davis. Inst. of Ecology.
For primary bibliographic entry see Field 2H.
W80-02669

GROUNDWATER QUALITY NEAR AN UNDERGROUND COAL GASIFICATION EXPERIMENT,
California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 2F.
W80-02674

PARTICULATE METALS IN WATERS OF A TYPICAL IRRIGATION RIVER: THE RIVER SAKURAGAWA, JAPAN,
Tsukuba Univ. (Japan). Inst. of Biological Sciences.
H. Seki, M. Takahashi, K. Kobayashi, and S. Ishizaka.
Water, Air, and Soil Pollution, Vol 12, No 2, p 265-271, August 1979. 3 Fig, 1 Tab, 19 Ref.

Descriptors: *Rivers, *Lakes, *Water pollution, *Metals, On-site investigations, Chromium, Mercury, Lead, Cadmium, Iron, Manganese, Zinc, Pollutants, Foreign research, *Japan, *River Sakuragawa(Japan).

The particulate metallic elements in waters of a water system of the River Sakuragawa and Lake Kasumigaura were measured by the multielement analysis using particle-induced X-ray emission. The heavy metal particulates for environmental standards were less than 0.0001 ppm for Cd, 0.00037 ppm for Cr, and 0.00078 ppm both for Hg and Pb in the river waters. The predominant metal particles in the waters were Fe, Mn, and Zn. (Humphreys-ISWS)
W80-02683

DEPOSITION OF NUTRIENTS AND MAJOR IONS BY PRECIPITATION IN SOUTH-CENTRAL ONTARIO,
Ontario Ministry of the Environment, Rexdale (Ontario). Limnology and Toxicity Section.
For primary bibliographic entry see Field 2H.
W80-02685

THE EFFECT OF HEAVY METALS AND OTHER POLLUTANTS ON THE SEDIMENTS OF ONONDAGA LAKE,
Syracuse Univ., NY. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W80-02686

POWER PLANT DIFFUSER-PIPE SYSTEM,
Auburn Univ., AL. Dept. of Civil Engineering.
A. D. Parr, and W. W. Sayre.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE6, Proceedings Paper 15048, p 1075-1093, December 1979. 7 Fig, 4 Tab, 8 Ref, 2 Append.

Descriptors: *Difusion, *Thermal pollution, *River, *Model studies, *Mississippi River, Hydraulic models, Flumes, On-site investigations, Temperature, Water temperature, Mixing, Powerplants, Flow, Velocity, Surveys, Standards, Water quality, Water quality standards, Diffusers, Diffuser-pipe systems.

Results were presented for a comprehensive model and prototype experimental study of a submerged multiport diffuser discharging heated water from a steam-electric generating station into the Mississippi River. The principal objectives of the study related to prediciting thermal mixing zones. Temperature and velocity distrubutions were studied in the region just downstream from individual ports in both model and prototype and at a cross section about 1/4 of the local river width downstream from the diffuser in the prototype. The river below which the applicable thermal standards would be violated was predicted. Comparisons showed that the performance of the prototype multiport diffuser ports can be represented satisfactorily by a 'sectional' laboratory flume model. (Sims-ISWS)
W80-02692

ASSIMILATIVE CAPACITY OF SMALL STREAMS,
Parsons, Brinckerhoff, Quade, and Douglas, Inc., New York.
C. T. Bathala, K. C. Das, and W. D. Jones.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE6, Proceedings Paper 15082, p 1049-1061, December 1979. 4 Fig, 2 Tab, 8 Ref, 2 Append.

Descriptors: *Streams, *Waste assimilative capacity, *Water quality, *Model studies, *Virginia, Dissolved oxygen, Biochemical oxygen demand, Mathematical models, Low flow, Sewage treatment, Effluents, Water pollution, Water pollution sources, Pollutants, Permits, Waste water, *Coleman Creek(VA), *Flat Creek(VA).

A rational basis for modeling small streams to determine assimilative capacity in order to assign waste-load allocations to meet the requrements of Public Law 92-500 is necessary. This paper summarized the results of waste-load assimilation analyses of Coleman Creek at Boydton and Flat Creek near South Hill, Virginia, and the possible impact on these communities. The assimilative capacity of each stream was analyzed by using modified Streeter-Phelps methodology, a water quality model for self-purification of small streams. Based on the results of these studies, it became apparent that very stringent effluent limits, overtaxing the financial capabilities of these communities, would be needed to maintain the existing stream DO standards. Accordingly, to prevent undue economic hardship to these communities, the concept of issuing a tiered permit was considered in order that a seasonally controlled system of waste treatment could be utilized, i.e., higher and more expensive treatment step may by required only during periods of low flow. These strategies will decrease the capital costs of the plants and will significantly lower the operating and maintenance cost. (Sims-ISWS)
W80-02693

SWMM APPLICATION TO COMBINED SEWERAGE IN NEW HAVEN,
Cardinal Engineering Associates, Meriden, CT.
For primary bibliographic entry see Field 2E.
W80-02694

5C. Effects Of Pollution

CHEMICAL AND BIOLOGICAL SURVEY OF THE UPPER GILA RIVER SYSTEM IN NEW MEXICO: PRELIMINARY STUDY OF NUTRIENTS IN SNOW AND QUEMADO LAKES,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Chemistry.
D. K. Brandvold, J. A. Brierley, and C. J. Popp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127269, Price codes: A04 in paper copy, A01 in microfiche. New Mexico State Water Resources Research Institute, New Mexico State University, Las Cruces, Report No 110, November 1979. 48 p, 18 Fig, 13 Tab, 19 Ref. OWRT A-060-NMEX(1), 14-34-0001-7006.

Descriptors: *Baseline study, *Water quality, *Eutrophication, *Heavy metals, Bacteria, Algae, Nutrients, *Gila River System(N Mex), Nutrient levels.

Baseline water quality was investigated for a sector of the Gila River System near its headwaters in New Mexico. A part of this system is very heavily used for recreation. In addition, three fishing/rec-

reational lakes were studied to attempt to find the causative factors for destructive algal blooms. Levels of nutrients, heavy metals, bacteria, and algae were determined in addition to general water chemistry profiles. It was found that although algal blooms occur, especially in Snow Lake, the nutrient levels were not exceptionally high. Elevated nitrogen concentrations were probably due to fixation of nitrogen by microorganisms. A significant factor seemed to be the available phosphate in Snow Lake. This lake also warmed earlier than Quemado Lake which may have been important in providing a longer period for algae growth. A few heavy metal levels were higher than would have been expected. No correlation appeared between bacterial counts and water chemistry. (Herman-New Mexico)
W80-02405

IMPACT OF WESTERN COAL MINING - II. MICROBIOLOGICAL STUDIES,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 5A.
W80-02416

OIL IN THE SEA,
A. D. McIntyre.
Scottish Fishery Bulletin, Vol 45, p 37-41, 1979.

Descriptors: *Oil pollution, *Commercial fishing, *Path of pollutants, Commercial fish, Commercial shellfish, Oil, Oil spills, Chemical properties, Toxicity, Mortality, Fish physiology, Animal metabolism, Oily water, Offshore platforms, Water pollution sources, *Crude oil.

Since the discovery of gas in the southern North Sea in the early 1960s and of oil at the Ekofisk field in 1969, there has been a progressive development of oil exploitation round Scottish coasts, extensive construction of onshore facilities and considerable expansion of oil transportation by ships and pipelines. There has also been a number of recent dramatic incidents in Western Europe - the Ekofisk Bravo blowout, the Amoco Cadiz grounding and the 'Eleni V' collision. It is thus natural that fishermen and anyone concerned with fish as food should ask for an assessment of the effects of oil in the sea. Many aspects of the effects of oil are discussed. First, an overview of the origin and composition of oil is given. The behavior of several types of crude oil when spilled is outlined. Next, the effects of oil on commercial organisms is addressed from two major aspects - the tainting of fish and shellfish and direct toxicity to these organisms. Finally, the effects on fishing of the physical presence of rigs, platforms or pipelines, and the damage which can be done to gear by debris on the sea bed are reviewed. (Deal-EIS)
W80-02418

IMPACT OF BIOLOGICAL AND CHEMICAL MOSQUITO CONTROL AGENTS ON NON-TARGET BIOTA IN AQUATIC ECOSYSTEMS,
California Univ., Riverside.
M. S. Mulla, G. Majori, and A. A. Arata.
Residue Reviews, Vol 71, p 121-173, 1979. 1 Tab, 207 Ref.

Descriptors: *Mosquitos, *Pest control, *Toxicity, Pesticides, Insecticides, Insect control, Public health, Biocontrol, Predators, Pathogenic bacteria, Chlorinated hydrocarbon pesticides, Organophosphorus pesticides, Carbamate pesticides, Larvicides, Mode of action, Pesticide toxicity, *Insect growth regulators.

In this review the ecological and environmental impact of biological and chemical control agents employed for the management and suppression of pest and vector mosquitoes in aquatic habitats is analyzed. Most, if not all, available published information has been scrutinized with regard to the most widely used control agents in aquatic ecosystems for mosquito control. Among the biological control agents, larvivorous and predaceous fish are the most commonly utilized agents for mosquito control at the present time. The general notion that all biocontrol agents are specific and have little or no effect on the nontarget biota are dispelled on the basis of available research data. From the evidence prevailing in the literature, some chemical control agents are quite innocuous while others pose a great potential hazard to nontarget biota. Efforts are and should be made to screen, evaluate, and develop more specific, less hazardous, and less toxic agents, formulations, techniques, and control strategies for the management of disease vectors and pestiferous arthropods. (Deal-EIS)
W80-02419

EFFECTS OF CHLORINATED ORGANICS FROM WASTEWATER TREATMENT ON ALGAL GROWTH,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
For primary bibliographic entry see Field 5A.
W80-02420

TOXICITY OF LANDFILL LEACHATES TO UNDERYEARLING RAINBOW TROUT (SALMO GAIRDNERI),
Fisheries and Marine Service, West Vancouver (British Columbia).
J. R. McBride, E. M. Donaldson, and G. Derksen.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 806-813, 1979. 4 Tab, 19 Ref.

Descriptors: *Toxicity, *Rainbow trout, *Leachate, Solid wastes, Landfills, Growth stages, Bioassay, Fish physiology, Fish diseases, Animal pathology, Mode of action, Chemical properties, Salmonids, *Tissue analysis, *Blood chemistry.

The objective of this study was to document the sublethal response of a salmonid (Salmo gairdneri) to leachate from a Greater Vancouver Regional District landfill site. To evaluate acute toxicity static 96 h LC50 bioassays were carried out. Values in four tests ranged from 5.8% to 7.5%. Sublethal toxicity was studied in two ways: histopathology and plasma corticosteroid concentration. Both concentration of leachate and length of exposure were varied for these tests. Leachates did not visibly affect the structure of liver, kidney, gill, skin or alimentary tract. In contrast, the interrenal, i.e., adrenocortical tissue homologue, of those fish exposed to the maximum concentration of the pollutant exhibited profound changes. Plasma cortisal concentrations were significantly elevated at maximum leachate concentrations for all exposure times. With one exception, small concentrations had insignificant effects on plasma cortisal levels. These changes were clearly due to a stress response induced by the leachates. (Deal-EIS)
W80-02422

EFFECT OF MERCURY ON THE MORPHOLOGY OF ERYTHROCYTES IN ANABAS SCANDENS,
Berhampur Univ., Orissa (India). Lab. of Environmental Toxicology.
For primary bibliographic entry see Field 5B.
W80-02423

RESUSPENSION OF OIL: PROBABLE CAUSE OF BROWN PELICAN FATALITY,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
K. A. King, S. Macko, P. L. Parker, and E. Payne.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 800-805, 1979. 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Water birds, *Mortality, *Oil spills, Oil, Oil pollution, Gas chromatography, Chemical analysis, Salt marshes, Oily water, Path of pollutants, Suspension, *Pelicans, *Pelecanus, Oil resuspension.

An adult brown pelican (Pelecanus occidentalis) was found oiled and died shortly thereafter. Gas chromatographic analysis linked the oil to a spill which had occurred six weeks earlier. The death of an individual of an endangered bird species 6 weeks after the original spill emphasizes that not all mortality associated with oil spills is immediate and obvious. Oil spilled in salt marshes persists for long periods; consequently special attention must be paid to these areas. Resuspension of oil trapped in pools or in sediments can result in the recontamination of adjacent waters. This is the first instance of which we are aware that resuspended oil may have resulted in bird mortality. (Deal-EIS)
W80-02425

COMPARATIVE EFFECTS OF SEDIMENT AND WATER CONTAMINATION ON BENTHIC INVERTEBRATES IN FOUR LAKES,
Alberta Environmental Center, Vegreville.
J. W. Moore, V. A. Beaubien, and D. J. Sutherland.
Bulletin of Environmental Contamination and Toxicology, Vol 23, p 840-847, 1979. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Heavy metals, *Toxicity, *Benthic fauna, *Mercury, *Copper, *Lead, *Zinc, Bottom sediments, Water chemistry, Bioindicators, Dominant organisms, Biological communities, Lakes, Arctic, Diptera, Mollusks, Amphipoda, *ARSENIC, *Species diversity, Canada.

Benthic invertebrate communities are often exposed to two sources of contamination, the substrate and the overlying water. This may create an interaction among pollutants and consequently, there have been few attempts to determine the impacts of both polluted water and sediments on benthic invertebrates. In this investigation the concentrations of heavy metals in the sediments and waters of four lakes situated in the Canadian subarctic were determined from May 1977 to May 1978 and were correlated with differences in the species composition, diversity and density of the benthic communities. The data were also used to assess the value of indicator species as measures of water pollution. (Deal-EIS)
W80-02428

THE POTENTIAL ENVIRONMENTAL IMPACT OF MARINE GRAVEL EXTRACTION IN THE NORTH SEA,
Rijksinstituut voor Visserijonderzoek, Ijmuiden (Netherlands).
S. J. deGroot.
Ocean Management, Vol 5, p 233-249, 1979. 4 Fig, 48 Ref.

Descriptors: *Dredging, *Fish populations, *Water pollution effects, Bottom sediments, Herrings, Gravels, Mining, Cost analysis, Eels, Commercial fishing, Excavation, Underwater, *Netherlands, *North Sea.

The rapid increase in the mining of marine gravels in the North Sea offers a serious threat to the marine environment and especially to the herring populations of the southern North Sea and Channel. The paper discusses the extraction methods for gravel and the usefulness of applying programmed dredging to minimize the effects on the seabed. The impact of gravel extraction on the sea-bed and on the herring and sand-eel fisheries is discussed. It is estimated that the resources of marine gravel in the southern North Sea will be depleted within 50 years whereas the fisheries will be practiced for many hundreds of years to come. Therefore a careful evaluation, on a European level, is needed of the relative short-term benefits for the marine gravel industry and the long-term interests of the fisheries. (Deal-EIS)
W80-02429

MARINE POLLUTION -- FACTS AND FICTION, THE SITUATION IN BRITAIN,
H. A. Cole.
Ocean Management, Vol 5, p 263-278, 1979. 26 Ref.

Descriptors: *Water pollution effects, *Aquatic environment, *Productivity, Commercial fishing, Commercial fish, Commercial shellfish, Herrings, Water quality, Water chemistry, Dissolved oxygen, Turbidity, Suspended solids, Sewage effluents, Metals, Organic compounds, Chlorinated hydrocarbon pesticides, Persistence, Water quality

standards, Radioactive waste disposal, *Great Britain.

The widely-held impression that serious biological damage has been done to the marine environment and its resources by pollutants is not soundly based. There is no evidence that any offshore stock of fish or shellfish has suffered a reduction in annual recruitment to the exploitable stock as the result of pollution. Production generally has been well maintained and where reduction in yield is evident, e.g. in herring around the British coasts, this is a consequence of over-fishing. Stocks of fish and shellfish inhabiting shallow coastal waters and particularly estuaries are subject to many human pressures, of which reduced water quality due to pollutants is one. The most damaging effects of pollution are reduction in available oxygen, increased turbidity due to suspended material and discolouration, and deposition of organic material on the bottom. Sewage and other organic effluents (such as food-processing wastes) with a high biological oxygen demand are the prime causes of these conditions. Potentially harmful metals and synthetic organic substances resistant to breakdown may accumulate in estuarine and coastal sediments, particularly muddy sands, silts and muds containing a high proportion of organic matter, and will continue to release potential pollutants long after shore discharges are controlled. Attention to marine pollution problems needs to be focussed on such estuarine and coastal sediments and the ways by which their polluting loads are built up and released. A better understanding of the effects of sewage discharge to the marine environment of the United Kingdom is needed and might bring about a modification of the present policy of sewage disposal. (Deal-EIS)
W80-02430

MODIFICATIONS OF AN EXPERIMENTALLY POLLUTED ECOSYSTEM IN THE LAGOON OF STRUNJAN, NORTH ADRIATIC,
Marine Biological Station, Portoroz (Yugoslavia).
For primary bibliographic entry see Field 5B.
W80-02432

THE EFFECT OF POLLUTION FROM LARGE-SCALE AGRICULTURAL PRODUCTION ON THE LIVING ENVIRONMENT OF THE FISH IN THE TROUT ZONE, (IN BOHEMIAN),
Vyzkumny Ustav Rybarsky a Hydrobiologicky Vodnany (Czechoslovakia).
A. Kominek.
Buletin VURH Vodnany, Vol 3, p 13-16, 1979. 2 Tab, 8 Ref. (English summary).

Descriptors: *Trout, *Toxicity, *Agricultural wastes, Flow rates, Streams, Benthic fauna, Mortality, Salmonids, Water temperature, Water pollution sources, Habitats, Dissolved oxygen, Water pollution effects, Agricultural runoff, Agricultural watersheds, Saprobic index, Trout, Freshwater fish.

The continuing pollution of trout waters, caused by agricultural production, affects with increasing severity the streams which are poorer in water, whereas those with higher flow rates are affected to a lesser degree. The difference in the worsening of saprobity in the two trout brooks---Krasovka and Stariesky potok---was about 1 saprobity degree in favour of the higher-flow brook. The best information on the effect of agricultural pollution on smaller trout waters is provided by the evaluation of the macrobenthos from the view-point of saprobic classification. The values obtained in the Krasovka signify the danger of the mortality of salmonids at lower flow rates and at higherwater temperatures at the same time. (Deal-EIS)
W80-02443

RELATIONSHIPS OF ACTIVITIES OF METAL-LIGAND SPECIES TO AQUATIC TOXICITY,
Minnesota, Univ.-Duluth. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W80-02444

AN ASSESSMENT OF THE THERMAL EFFECTS ON STRIPED BASS LARVAE ENTRAINED IN THE HEATED DISCHARGE OF THE INDIAN POINT GENERATING FACILITIES UNITS 2 AND 3,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5A.
W80-02446

A RELATION BETWEEN LAKE MORPHOMETRY AND PRIMARY PRODUCTIVITY AND ITS USE IN INTERPRETING WHOLE-LAKE EUTROPHICATION EXPERIMENTS,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
E. J. Fee.
Limnology and Oceanography, Vol 24, No 3, p 401-416, May 1979. 9 Fig, 1 Tab, 49 Ref.

Descriptors: *Ontario, Canada, *Experimental lakes area, *Primary productivity, *Lake morphometry, *Lakes, Eutrophication, Epilimnion, Mathematics, Mathematical studies, Nutrients, Phosphorus, Nitrogen, Algae, Phytoplankton, Sedimentation, Sediment-water interfaces, Depth, Volume, Cycling nutrients, Chlorophyll, Sediments, Correlation analysis.

Primary production rates expressed per epilimnion unit volume linearly relate to the ratio of epilimnion sediment area to epilimnion volume in unfertilized lakes in the Experimental Lakes Area (ELA), northwestern Ontario. This ratio is mathematically equivalent to the probability of sedimenting particle retention in the epilimnion divided by the mean epilimnion depth and measures lake nutrient recycling rates. The problem of relating lake morphometry and thermal structure to primary production came into prominence during primary production data analysis of a 4-year period at ELA. In comparison to control lakes, the ratio of production to chlorophyll in experimental lakes is high when chlorophytes dominate and low when cyanophytes dominate. Lakes fertilized with both nitrogen and phosphorus have much higher chlorophyll concentrations and productivities than control lakes. Both nutrients are in short supply; however, phosphorus is still the key for controlling eutrophication. Epilimnion nutrient recycling in ELA lakes is dominated by processes occurring at the sediment-water interface. The relationship between the ratio of sediment area to epilimnion volume and primary production is used to interpret whole-lake eutrophication experiments. (Danovich-Wisconsin)
W80-02462

AN EXAMINATION OF THE EFFECTS OF NUTRIENTS ON THE WATER QUALITY OF SHALLOW RIVERS,
Ontario Ministry of the Environment, Toronto. Limnology and Toxicity Section.
S. L. Wong, B. Clark, and R. F. Kosciuw.
Hydrobiologia, Vol 63, No 3, p 231-239, 1979. 8 Fig, 4 Tab, 46 Ref.

Descriptors: *Nutrients, *Water quality, *Rivers, *Shallow water, *Dissolved oxygen, Lotic environment, Plant populations, Plant growth, Oxygen, Oxygen demand, Biological communities, Respiration, Plant physiology, Biomass, Standing crops, Productivity, Growth rates, Model studies, Algae.

Although nutrient removal prevents further water quality deterioration, both qualitative and quantitative manipulation of plant communities is necessary to maintain desirable oxygen levels. Unlike lake systems, river quality cannot be characterized by nutrient concentrations. Although BOD is frequently used to monitor waste loading, enriched river sections other than those exposed to immediate outfalls, will not necessarily exhibit BOD problems. Higher plant communities together with benthic and periphyton populations are responsible for nighttime oxygen depletion. Minimum respiration rate derived during hours of total darkness comparatively better describes the plant community than daily mean respiration values. When dissolved oxygen criteria are considered in eutrophication models, nutrient concentration may not represent the prime controlling factor. External nutrient conditions may also not relate to plant growth: a plant's capacity for high nutrient storage hinders determining nutrient sufficiency levels. Differences in nutrient uptake were observed in Claophora in lentic and lotic environments. Nutrient sufficiency levels are not shared by all plants communities, especially when complicated by the unknown effects of root systems. Dissolved oxygen content is governed to a great extent by plant biomass distribution, a neglected parameter in water quality. Therefore, quantitative biomass control measures must be incorporated into water quality management plans for shallow rivers. (Danovich-Wisconsin)
W80-02463

PHYSICO-CHEMICAL ENVIRONMENT, PHYTOPLANKTON BIOMASS AND PRODUCTION IN OLIGOTROPHIC, SOFTWATER LAKE KALGAARD, DENMARK,
Aarhus Univ. (Denmark). Botanical Inst.
M. Sondergaard, and K. Sand-Jensen.
Hydrobiologia, Vol 63, No 3, p 241-253, 1979. 10 Fig, 3 Tab, 42 Ref.

Descriptors: *Lake Kalgaard, Denmark, *Productivity, *Biomass, *Phytoplankton, *Physicochemical properties, Oligotrophy, Chlorophyll, Primary productivity, Water chemistry, Nitrates, Phosphates, Seasonal, Algae, Nitrogen, Limiting factors, Phosphorus, Chemical analysis, Chemical properties, Carbon dioxide, Ions, Secchi disks, Depth, Distribution.

Physico-chemical environment, phytoplankton biomass and production in Lake Kalgaard, Denmark, 1976-1977 is described. Kalgaard is a small seepage lake (10.5 ha) with 11 m maximum depth. A well defined hypolimnion is absent. Chemically the lake is characterized by low total C02 and inorganic nutrient (N,P) concentrations and by Na and Cl ionic dominance. The ionic composition resembles that of precipitation (Na>Ca>Mg>K and Cl>S04>HC03). Total C02 increased markedly during July from 250-600 kg C/lake, primarily due to bottom accumulations, and afterwards decreased from September to October. N03 concentrations were relatively high from late autumn through spring (80 micro g/l) and dropped to extremely low values (1 micro g/l) during summer. P04 shows that the opposite pattern and is detectable only during summer (12 micro g/l). Chlorophyll a concentrations were below 10 micro g/l in surface waters (0.4 m) apart from a single maximum in September (45 micro g/l). During summer stagnation, a pronounced chlorophyll a maximum (100 micro g/l), developed at 6 m. Algal growth at 6 m is possible since the euphotic zone extends into the metalimnion: Secchi disc transparency is 4-6 m. Nitrogen is the major factor limiting biomass during summer stratification whereas phosphorus is more important at other seasons. Annual production (55 g C/sq m yr for deepest part, 32 g C/sq m yr average lake) shows that Kalgaard is an oligotrophic, softwater lake. (Danovich-Wisconsin)
W80-02464

NOTE ON RAPID AND SENSITIVE METHOD FOR THE DETERMINATION OF ANIONIC DETERGENTS IN NATURAL WATERS, AT THE PPB LEVEL,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
M. S. Gagnon.
Water Research, Vol 13, No 1, p 53-56, 1979. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Analytical techniques, *Solvent extraction, *Measurement, *Detergents, *Anions, Spectrophotometry, Testing, Testing procedures, Copper, Water chemistry, Chemical analysis, Chemistry, Freshwater, Saline water, Waste water(Pollution), Methodology, Pollution identification.

A rapid and sensitive method for determining anionic detergents in natural waters is developed from the original work by Crisp using bis (ethylenediamine) copper (II) ion. Standard reference anionic detergent solution sodium doecyl sulfate (SDS) is used with ethylenediamine Cu (II) as a

reagent. The ratio of sample:reagent:chloroform is maintained at 20:1:1. Atomic absorption spectrophotometry is also used. The procedure is suitable for 0-50 micro g/l detergent (SDS) concentrations but its applicability extends up to 15 micro g/ml. Recovery is 80% at 1 micro g/l, reaches 90% at 10 micro g/l and is 97% at higher concentrations. Method detection limit, or the concentration which gives an absorbance value equal to twice the standard deviation, is 0.3 micro g/l. Interference by natural organic chelators can occur when detergent concentrations were at the ppb level. Continuously measuring the chloroform-extractable copper in the sample evaluates possible error and obtains better detergent concentration accuracy. (Danovich-Wisconsin)
W80-02465

QUANTITATIVE DESCRIPTION OF STEADY STATE, NUTRIENT-SATURATED ALGAL GROWTH, INCLUDING ADAPTATION,
Rochester Univ., NY. Dept. of Biology.
T. T. Bannister.
Limnology and Oceanography, Vol 24, No 1, p 76-96, 1979. 8 Fig, 7 Tab, 64 Ref.

Descriptors: *Equations, *Algae, *Growth rates, *Light, *Mathematical studies, *Irradiation, Phytoplankton, Photosynthesis, Respiration, Chlorophyll, Adaptation, Nutrients, Equilibrium, Cultures, Limiting factors, Publications, Surveys, Cytological studies, Light intensity, Chlorella, Laboratory tests, Mathematics.

Four simple equations together with values of eight constant parameters provide a complete, self-consistent, reasonably accurate description of nutrient-saturated algal growth. The theory proves that C:chlorophyll a ratio (theta), respiratory rate (R-p), and light saturation parameter (E-p) of the photosynthetic light curve, alone are adaptative, and that adaptation of these parameters underlies the differences between light curves of growth and photosynthesis. The new model of nutrient-saturated growth incorporates the results of Phillips and Meyers on Chlorellpyrenoidosa cultures at 26 C under continuous illumination. Derived equations agree with experimental ones. Phytoplankton growth is described by four equations: (1) an empirical equation relating growth rate and absorbed irradiance; (2) a different equation relating growth rate and absorbed irradiance derived from equation; (3) an empirical equation relating R-p to growth rate; and (4) an equation stating the approximate constancy of the ratio E-p:thta. The equations can be solved simultaneously. Since they not only described respiration and light curves of growth and photosynthesis but also predict E-p and theta, the equations constitute an improved model of nutrient saturated algal growth; given any irradiance the equations predict growth rate, R-p, E-p, theta, and the specific photosynthetic light curve. (Danovich-Wisconsin)
W80-02466

ENRICHMENT OF ZN, CD, PB, AND CU IN THE SURFACE MICROLAYER OF LAKES MICHIGAN, ONTARIO, AND MENDOTA,
Clemson Univ., SC. Dept of Environmental Systems Engineering.
A. W. Elzerman, and D. E. Armstrong.
Limnology and Oceanography, Vol 24, No 1, p 133-144, 1979. 1 Fig, 8 Tab, 28 Ref.

Descriptors: *Surface tension, *Heavy metals, *Lake Michigan, *Lake Ontario, *Accumulation, *Lake Mendota(WI), *Monomolecular films, Physicochemical properties, Surfaces, Trace elements, Physical properties, Chemical properties, Lakes, Microenvironment, Lead, Zinc, Cadmium, Copper, Capillary action, Surfactants, Water properties, Surface waters, Films, Surface microlayers.

Data from Lakes Michigan, Onratio, and Mendota, 1973-1975, show that Zn, Cd, Pb, and Cu surface enrichment is common. Film pressures in areas of capillary wave damping are typically 2-10 dyn/cm. Concentrations of Zn, Cd, Pb and Cu are highest in rivers and harbor samples; heavy slicks in Lakes Michigan and Ontario exhibit surface pressures exceeding 22 dyn/cm. Lake Michigan midlake samples show lowest concentrations and least variability. Screen-collected surface microlayers samples generally contain higher Zn, Cd, Cu and especially Pb concentrations than samples from 30-m depth at the same site. Surface enrichment frequency and extent, especially for Pb, is greater in the presence of surface-accumulated material (SAM) as evidenced by visible foam or particulate matter or a film pressure 1 dyn/cm. Film pressure positively correlates with surface enrichment. Fractionation ratio and surface excess data indicate 100 ppm Zn, Cd, Pb and Cu concentrations may occur in the surface-enriched layer depending upon the actual SAM location. Trace metal surface enrichment is significant despite the small surface microlayer volume compared with total lake volume. Interactions between materials in the surface microlayer, including organic matter, particulate matter and microorganisms could be influenced by high trace metal concentrations. Capillary wave damping was frequently observed in all lakes. (Danovich-Wisconsin)
W80-02467

DYNAMICS AND CONTROL OF THE ASIATIC CLAM IN THE NEW RIVER, VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
D. S. Cherry, J. H. Rodgers, Jr., R. L. Graney, and J. Cairns, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-129703, Price codes: A05 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University Bulletin 123, 1980. 72 p, 14 Fig, 16 Tab, 47 Ref. OWRT B-101-VA (1).

Descriptors: Toxicity, Bioconcentration, Bioassays, Powerplants, Heated water, Nuisance shellfish, *Corbicula, *Asiatic clam, Population density, New River(VA).

The Asiatic clam, Corbicula fluminea, has invaded the New River at the rate of 9 miles a year from the Kanawha River, which enters downstream from the Glen Lyn coal-powered generating plant in Virginia. During the period of investigation, October 1976-September 1978, clams were more numerous in the vicinity of the thermal discharge of the plant than they were in unheated waters, and their population fell sharply during the winter months, when the water temperature dropped to approximately 2C. The temperature (35C) of the heated discharge water in late summer did not adversely affect the clam. High mortality occurred at temperatures greater or equal to 36C in laboratory thermal tolerance studies. The clam proved to be highly resistant to the conventional biocidal practice of intermittent chlorination and to exposure to heavy metals in both static and artificial stream bioassays. Copper was more toxic than either zinc or a combination of zinc and copper. Potassium was not an effective biocidal agent at low concentrations (less than 100 mg/l). Measurements of 42 elements in water, sediment, clam shell, and visceral tissue revealed that Corbicula was an efficient accumulator of many elements. Concentrations in all tissue samples were greater than those measured in river water. Fifteen elements were more concentrated in tissue samples than in river sediment, but the converse was true for 25 elements. Elements released from discharges at the Glen Lyn plant did not limit the clam's development or ability to propagate. Although only minor incidents of Corbicula infestation have been observed in the cooling system of the power plant, such infestation could become a serious problem if winter water temperatures rise. No effective means of controlling the clam's population has been developed.
W80-02471

BIOASSAYS RELATED TO THE EFFECTS OF COAL STRIP MINING AND ENERGY CONVERSION ON THE AQUATIC MICROFLORA,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 5A.
W80-02476

RANGE OF CHANGES IN FISHPOND ENVIRONMENT INFLUENCED BY INTENSIVE CARP FARMING,
Polish Academy of Sciences, Golysz. Fish Culture Station.
J. Szumiec.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2137-2141. 6 Fig, 4 Ref.

Descriptors: *Fish farming, *Water quality, *Carp, *Phytoplankton, *Oxygenation, *Dissolved oxygen, Eutrophication, Aquatic productivity, Fish, Freshwater fish, Fish populations, Density, Population, Oxygen, Fish management, Aquiculture, Oxygen requirements, Water quality control, Nitrogen, Nitrogen compounds.

In intensive carp farm ponds (4000 kg/ha) mean daily primary production reaches 4 g 02/sq m most of the year and 7 g 02/sq m maximum in July from phytoplankton assimilation; nitrate and nitrite values are low, proving that they are quickly assimilated by bacteria and phytoplankton. In surface waters on sunny days, phytoplankton assimilation reaches 25 g 02/sq m. Despite greater phytoplankton numbers in intensive ponds, ponds are usually less oxygenated than fertilized ones (900 kg/ha) due to high oxygen consumption and weak light conditions. Carp in intensive ponds require up to 40 kg 02/ha/d for respiration and food digestion. Nevertheless, organic substance accumulation, expressed by oxidability, does not reach values at which anoxia is expected. Transparency in euphotic layers decreases from 120 cm in spring to 40 cm in summer. Artificial aeration can improve oxygen balance but is justified only at 8000 kg/ha production levels. In intensive ponds, undissociated ammonia concentrations are below 0.1 mg/l although these values are present in fertilized ponds. Nitrogen in intensive ponds is present mainly in organic or ammonia nitrogen forms, usually as decay products. (Danovich-Wisconsin)
W80-02486

ENDOHELMINTHS OF SALMONIDA FROM THE ARTIFICIAL LAKE PIVA, MONTENEGRO, YUGOSLAVIA,
Biological Inst., Titograd (Yugoslavia).
D. Kazic.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978. p 2154-2158, 2 Fig, 3 Tab, 3 Ref.

Descriptors: *Fish disease, *Lake Piva, Yugoslavia, *Piva River, Yugoslavia, *Salmonids, *Ecological distribution, *Fish parasites, *Trematodes, *Nematodes, Parasitism, Infection, Yugoslavia, Dominant organisms, Distribution, Hosts, Epizootiology, Fish populations, Pathology, Brown trout, Rainbow trout.

Pathogenicity produced by Crepidostomum species, trematodes, is restricted to Piva River (Yugoslavia) headwaters and trout occurring in Piva Lake have few parasites. Regions of the Piva River and its tributaries have been impound since 1975 to make an artificial lake 44 km long and 200m deep. Predominate parasites in the river include trematodes Crepidostomum farionis and C. metoecus; they occur in fish stomachs (6.32%) intestines (53.37%), and gall bladder (53.16%). Infection intensity reaches a maximum 1,2000 organisms. Smaller numbers of fish have other trematodes such as Nicolla testiobliqua, Allocreadium isoporusm, and Sphaerostomum globiporum. In Piva River tributaries, the same parasite species occur; however, some differences are present in numbers of hosts infected by some indohelminth classes. Piva River fish are affected more by trematodes than those in tributaries, while fish in tributaries are more affected by nematodes. Infection rates intributaries are also lower, (up to 48 parasites). In Piva Lake, 70.81% of brown trouts caught are infected: trematodes occur in 60.28% nematodes in 23.93%. C farionis species is common however, infection intensity reaches only 13 parasites. Nicolla testiobliqua infection intensity reaches 83 parasites. The most common nematode is Sterliadochona tenuissima. (Danovich-Wisconsin)

W80-02490

UTILIZATION OF FILAMENTOUS ALGAE BY FISHES IN SKADAR LAKE, YUGOSLAVIA,
Wisconsin Univ., Madison. Lab. of Limnology.
J. F. Kitchell, R. A. Stein, and B. Knezevic.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2159-2165, 2 Fig, 2 Tab, 15 Ref SFG-2-6308.

Descriptors: *Skadar Lake, Yugoslavia, *Fish diets, *Algae, *Food chains, *Cyprinid fish, *Nutrients, Fish, Fish behavior, Fish populations, Nutrient requirements, Phytoplankton, Metabolism, Fish physiology, Digestion, Food, Food habits, Biological communities, Ecology, Ecosystems, Food abundance.

Filamentous algae, although of low nutritional value, represents an abundant, readily accessible food resource for cyprinid fish Pachychilon pictum, Leuciscus cephalus and Rutilus rubilio, studied in Skadar Lake, Yugoslavia June-July 1973. Skadar Lake, located in Montenegro, Yugoslavia is a large, shallow, polymictic, subtropical lake; surface area varies 370-530 sq km due to annual flooding. Even though fish differ substantially in initial gut content weight, they have very similar gut clearance rates. Time for 50% depletion is 3.4 h. Guts are empty of digestible food 8 h after feeding. L. cephalus assimilation efficiency reaches 80% based on particulate matter recovered by dissection and filtration. Because depletion rates are similar, intercept values represent relative importance of algae in each species' diets. In decreasing order, it is R. rubilio, L. cephalus, and P. pictum. Algae comprises 42% of L. cephalus diet, 69% for P. pictum, and 89% for R. rubilio during June through September. All fish have fat deposits suggesting no energy deficits during mid-summer when algae is the primary food resource. Ash and indigestible organic matter for fresh Spirogyra is 41.2% and 5.4%, respectively, making digestible organic matter 53.4%. During digestion, ash content declines to 25%, probably resulting from dissolution of CaC03. Fecal matter contains more ash and indigestible matter and less digestible organic matter than fresh Spriogyra. (Danovich-Wisconsin)
W80-02491

UNIQUE CHARACTERISTICS OF ICHTHYOFAUNA AND ICHTHYOPARASITES OF SKADAR LAKE,
Biological inst., Titograd (Yugoslavia).
B. Knezevic, D. Kazic, D. Nedic, M. Kavaric, and B. Ivanovic.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2166-2171, 3 Tab, 29 Ref.

Descriptors: *Skadar Lake, Yugoslavia, *Fish, *Fish parasites, *Systematics, Fish types, Fish populations, Adaptation, Invasion, Pathology, Parasitism, Biomass, Infection, Trematodes, Nematodes, Hosts, Epizootiology, Speciation, Dominant organisms, Cyprinid fish, Climates, Water temperature.

Skadar Lake, Yugoslavia, is characterized by fish species of 15 families; Cyprinidae dominate with 96% of thebiomass and Cyprinus and Alburnus are the most commercially significant fish. Salmoniae are considered temporary lake species. In the last few years, seven new fish species were recorded; the majority are Cyprinidae. Increases in Carassius auratus biomass is foreseen, causing a decrease in many native species. Parasitological investigations reveal fish species infected and total invasion intensity: Gubio gobio (99.09%), Leuciscus cephalus albus (74.41%), Pachychilon pictum (73.51%), Alosa fallax nilotica (67.72%), and Chondrostoma kneri (62.81%). Parasites include trematodes, nematodes, cestodes, nad to a lesser extent, Acanthocephala. Pachychilon pictum is an endemic Skadar Lake species: 10 trematodes, seven nematodes, three cestodes, and four Acantocephala species are found in it. Extensive fish infection is explained by warm water temperatures brought about by the mild climate influencing more intensive fish nutrition and aquisition of invertebrate intermediate hosts over long time periods. Skadar Lake has potential human and mammal pathogenic lavae in several fish species; in addition, several larval forms can be transmitted to wild water birds. (Danovich-Wisconsin)
W80-02492

SIZE-SELECTIVE PREDATION BY FISH ON THIN-SHELLED GASTROPODS (LYMNAEA): THE SIGNIFICANCE OF FLOATING VEGETATION (TRAPA) AS A PHYSICAL REFUGE,
Oklahoma Univ., Norman. Dept. of Zoology.
A. P. Covich, and B. Knezevic.
In: Proceedings, Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2172-2177, 3 Fig, 20 Ref SFG-2-6308.

Descriptors: *Fish food organisms, *Skadar Lake, Yugoslavia, *Carp, *Floating plants, *Ecological distribution, *Gastropods, *Predation, Fish, Fish diets, Aquatic plants, Speciation, Habitats, Mollusks, Snails, Nitches, Ecotypes, Distribution.

Preliminary gastropod distribution surveys in the littoral zone of Lake Skadar, Yugoslavia, October 1975-July 1976 reveal that spine development in submerged Trapa fruits offers protection to Lymnaea from fish predation. Skadar Lake surface area fluctuates 370-530 sq km as water level rises 2 m in winter and early spring; transparency varies 0.5-3.0 m with high turbidity in winter. Many individual carp select small, thin-shelled species (Valvata piscinalis) over thicker-shelled, common ridged-morphs (Pyrgula annulata) apparently because Valvata can be crushed more readily by carp's pharyngeal teeth. However, Lymnaea auricularia are the most abundant thin-shelled species and are larger than Valvata. Dominant plants in the littoral zone are floating (Trapa longicarpa) and submerged species (Ceratophyllum desersum, Myriophyllum verticillatum, and Potamogeton natans). Lymnaea auricularia densities on Trapa range from 10-36/sq m. Sediment samples below Trapa beds contain low Lymnaea numbers. Data show high predation rates on small L. auricularia regardless of Trapa presence. However, predation on large L. auricularia declines when Trapa is present as a refuge. Trapa prescence, therefore, has less significance as a refuge for small gastropods than it does for larger ones. Because carp are primarily bottom feeders, they may infrequently search for prey on floating vegetation; spines reinforce Trapa's spatial refuge effectiveness. (Danovich-Wisconsin)
W80-02493

ALGAL POPULATIONS IN A MOUNTAIN POND (SWISS NATIONAL PARK),
Hydrobiological and Limnological Station, Kilchberg (Switzerland).
F. Schanz.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2188-2193, 2 Fig, 3 Tab, 8 Ref.

Descriptors: *God dal Fuorn Pond, Switzerland, *Algae, *Succession, *Chemical properties, *Population, *Trace elements, Water chemistry, Biomass, Primary productivity, Standing crops, Water properties, Cyanophyta, Bacteria, Mosses, Nutrients, Aquatic life, Ponds, Mountains, Density, Plankton, Phytoplankton.

Algal samplings of God dal Fuorn pond, Swiss National Park, 1975-1977, reveal special bacterial and blue-green algal species (Beggiatoa alba, Lamprocystis roseo-persicina, Thiocystis violacea, Desulfovibrio desulfuricans) which are able to adapt to a high content of sulfate, iron, magnesium and calcium in the water. The pond, with 43.5 cu m volume and 2.5 m maximum depth, has low oxygen content and traces of hydrogen sulfide. Dissolved ion concentration have been fairly constant for 40 years; human and animal pollution effects are practically negligible. Algal distribution occurs in three separate habitats: open water, bottom, and near Chara- and moss vegetation. Open water (50 ml) contains only 10-50 individual diatoms. Chara contraria and Chara foetida make up the most important benthos algal species; filamentous algae Spirogyra, Mougeotia, and Zygnema are also quantitatively important. Most algal species grow near Chara- or moss-vegetation and green algal numbers are markedly higher in these areas; species include Microspora amoena, Oocystis naegelii, Eremosphaera viridis, Cosmarium botrytis, Spirogyra, Mougeotia, and Microcystis parasitica. Pond algal biomass is descended from Characeae and Conjugatophyceae. Species succession in July-September is not detectable: monthly changes in algal densities are not evident. Biomass production is low because inorganic phosphorus and nitrogen levels are not detectable. (Danovich-Wisconsin)
W80-02495

ROLE OF NANNOPLANKTON IN PRIMARY PRODUCTIVITY STUDIES IN TROPICAL PONDS,
North Eastern Hill Univ., Shillong (India). Dept. of Zoology.
R. G. Michael, and V. M. Anselm.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretishce und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2196-2201, 4 Fig, 2 Tab, 21 Ref.

Descriptors: *Nannoplankton, *India, *Ponds, *Primary productivity, *Tropical regions, *Algae, *Productivity, *Size, *Cytological studies, *Freshwater, *Light, Phytoplankton, Surveys, Light-dark bottle method, Analytical techniques.

Nannoplankton composition and absolute productivity values differ widely in 21 ponds near Madurai area of India; however, their gross and net contributions are quite similar to those of total plankton, reemphasizing nannoplankton significance incontrolling primary productivity. This survey provides further evidence on the significant contribution of nannoplankton, probably due to light utilization efficiency enhanced by decreased organism size. Nannoplankton is represented by four major algal groups: Chlorophyceae, Cyanophyceae, Bacillariophyceae, and Euglenophyceae. The maximum number of Chlorophyceae is 250,000/1, Cyanophyceae 250,000/1, Bacillariophyceae 75,000/1 and Euglenophyceae 2,500/1. Under tropical conditions, major phytoplankton components fall within nannoplankton size ranges and productive potential is largely controlled by nannoplankton size algae. In almost 60% of the ponds, net production forms 50-97.9% of the gross production in both total and nannoplankton indicating high P:R ratios. In nine ponds, gross nannoplankton production constitutes a considerable portion (77%) of gross total plankton production. However, in 11 other ponds, nannoplankton gross production exceeds that of gross total plankton production (137%). (Danovich-Wisconsin)
W80-02496

DENITRIFICATION IN THE SEDIMENTS OF LAKE OKEECHOBEE,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
J. J. Messer, and P. L. Brezonik.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2207-2216, 4 Fig, 3 Tab, 24 Ref.

Descriptors: *Lake Okechobee, Florida, *Sediments, *Dentrification, *Nitrogen compounds, *Sediment-water interfaces, Nitrates, Nitrites, Biochemistry, Nitrogen, Phosphorus, water pollution sources, Nutrients, Bacteria, Chemical properties, Chemical analysis, Aquatic plants, Lakes, Vegetation.

Denitrification, as measured by mass balance calculations, acts as a significant nitrogen sink in Lake Okeechobee, Florida, a large freshwater lake with 1850 sq km surface area and 2.7 m mean depth. The Kissimnee River is the most important nitrogen (N) source. Other important N sources include backpumped irrigation water from the Everglades agricultural area and rainfall. Phpsphorus (P) loading is dominated by Taylor Creek, which drains a

heavily pastured watershed. The Kissimmee River, rainfall, and backpumping also contribute to P loading. Areal loading is 4.23 g N/sq m-yr and 0.367 g P/sq m-yr. Nitrate and dentrification profiles indicate that spatial nitrification and denitrification relationships are more comlex than those occurring in undisturbed sediments. Based on a weighted areas average for different sediment types, the N:P ratio is 7.0. Nitrate concentrations and the N:P ratio decrease in similar patterns from the top few centimeters of sediment down to 20 cm. Below 20 cm, N:P ratio is constant and nitrate levels are low. Nitrate diffuses upward into the water and downward into anoxic sediments from the nitrate maximum. As much as 1.78 billion g N is denitrified annually in the lake, accounting for 26% of annual input. This N loss indicates an average denitrification rate of 0.96 g N/sq m-yr. Denitrification is unlikely in aerobic water columns and rates result from sediment reactions. An important storage not considered in calculations are extensive macrophyte (Potamogeton) beds in southwest lake sections. (Danovich-Wisconsin)
W80-02498

DENITROGEN FIXATION AND DENITRIFICATION IN SOME DANISH LAKES,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
V. B. Jensen, and K. I. Dahl-Madsen.
In: Proceedings: Congress in Denmark 1977. Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2217-2221, 1 Fig, 2 Tab, 10 Ref.

Descriptors: *Nitrogen fixation, *Denitrification, *Lakes, *Denmark, Nitrogen, Nitrogen cycle, Nutrients, Water pollution, Nutrient removal, Waste waters, Water quality, Effluents, Surveys, Phosphorus, Nutrient budgets, Nutrient loading, Cycling nutrients.

Surveys of denitrogen fixation (DF) and denitrification in Danish lakes reveal that estimated dentrification rates are the same magnitude as proposed nitrogen (N) loadings, therefore, N removal could be cancelled by changed denitrification. However, the most pronounced effects of N removal occur in severely N-limited lakes, which usually also have the lowest denitrification rates. Lack of quantitative knowledge of relations between dentrification rates and environmental conditions for Danish lakes limits predictions of proposed N removal effects by general statistical models. Accumulated frequency curves for denitrification rates show a median of 9 g/sq m/yr; the 95th percentile is 50 g/sq m/yr. Median of the rates relative to N inflow is 13%; 95th percentile is 49%. Denitrification rates depend on surface area, mean depth, hydraulic retention time, nitrogen inflow, and phosphorus inflow. Nitrogen inflow is the dominating factor but no clear relations between parameters are apparent. Dinitrogen fixation measurements in lake summer 1974 for two Danish lakes were 2.0 g N/sq m/yr (011erup) and 1.0 g N/sq m/yr (Hvidkilde). Comparing DF rates to other N balance parts shows that DF does not contribute to N flow on a yearly basis, however, in late summer when N flow is low, DF is expected to significantly contribute to the N balance. (Danovich-Wisconsin)
W80-02499

MICROBIAL HETEROTROPHIC PRODUCTION IN TWO LAKES OF DIFFERENT PRODUCTIVITY,
New York State Dept. of Education, Albany. State Science Service.
R. H. Monheimer.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2222-2226, 2 Fig, 8 Ref. NSF BMS75-03352, DEB76-10591.

Descriptors: *Lake George(NY), *Canadarago Lake(NY), *Primary productivity, *Photosynthesis, *Heterotrophy, *Absorption, *Carbon cycle, *Sulfates, Plankton, Algae, Phytoplankton, Microorganisms, Oligotrophy, Eutrophication, Productivity, Timing, Depth, Light, Sulfur bacteria, Tracers.

Deviations from an expected correlation between sulfate and carbon uptake occur twice as often in Lake George as in Canadarago Lake, New York; therefore, heterotrophic productivity, as it relates to primary productivity is more important in oligotrophic than eutrophic waters. Low deviation rates in more eutrophic Canadarago Lake are due to the dominant algal role in sulfate uptake which diminishes heterotrophic productivity importance. Both uptake rates were measured with basic radioisotopes tracer techniques. Generally, both lakes' depth profiles exhibit sulfate uptake rates that parallel inorganic carbon uptake rates. However, in Canadarago Lake, five deviation incidents occurred where sulfate uptake rates increased while primary productivity decreased and five incidents occurred where sulfate uptake rates decreased while primary productivity increased. Similarly, in Lake George, variation incidents were six and ten, respectively. Normalized average time profiles show greater deviations in parallelism between carbon and sulfate uptake rates. An increase in sulfate uptake when primary productivity decreases means that heterotrophy is increasing. Heterotrophic production accounts for 37% of total planktonic microbial production in Lake George, but only 15% in Canadarago Lake. (Danovich-Wisconsin)
W80-02500

RESPONSES OF PHOSPHORUS REMOBILIZING CYTOPHAGA SPECIES TO NUTRITIONAL AND THERMAL STRESS,
Maryland Univ., College Park. Dept. of Microbiology.
W. Reichardt.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2227-2232. 7 Fig, 10 Ref.

Descriptors: *Nutrients, *Thermal stress, *Lake Constance, West Germany, *Growth rates, *Cytophaga, *Limiting factors, *Enzymes, Bacteria, Phosphates, Sediments, Phosphorus, Metabolism, Biochemistry, Microorganisms, Population, Biomass, Temperature, Nutrient requirements, Anaerobic bacteria, Anaerobic conditions, Aerobic bacteria, Water chemistry.

Alkaline phosphatase (AP-ase) activities of Cytophaga populations in Lake Constance, West Germany, are useful in describing potential phosphate enzymatic remobilization in lake water and sediments. Sediment samples with 20 mM glucose/1 as an additional carbon source over short-time incubations have no significant influences on phosphatase levels. However, in hypolimnetic water, substrate accelerated Cytophaga elimination sets in after additional sources of carbon (glucose), organic phosphorous (beta-glycero-phosphate) and inorganic phosphorous (Na4P207), with glucose and Na4P207 preferently at higher temperatures (20C), with beta-glycero-phosphate most significantly at lower temperatures (5C). These temperatures-dependent population shifts occur as a response to growth limiting substrates populations are lacking. Experiments with Na4P207 at 5C show exceptional growth promotion. In Lake Constance sediments. AP-ase producing bacteria and AP-ase positively correlate only in topmost (0-1) layers. AP-ase production stimulation under restricted oxidative phosphorylation conditions, as assumed for deep, anaerobic sediment layers holds true only for Cytophaga johnsonae, but not for Chromobacterium lividium. (Danovich-Wisconsin)
W80-02501

POLYSACCHARIDE DEGRADATION BY AQUATIC CYTOPHAGA POPULATIONS IN A EUTROPHIC LAKE AND IN MIXED CULTURES,
Gesellschaft fuer Biotechnologische Forschung, Stockheim (Germany, F.R.).
H. Gude.
In: Proceedings, Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte limnologie, Vol 20, Part 4, 1978, p 2233-2237. 3 Fig, 15 Ref.

Descriptors: *Lake Constance, West Germany, *Enzymes, *Degradation(Decomposition), *Organic compounds, *Cytophaga, Eutrophication, Bacteria, Lakes, Batch cultures, Decomposing organic matter, Temperature, Succession, Population, Growth rates, Biomass, Microorganisms, Biochemistry, Ecology, Sediments, Littoral, Pelagic zone.

Field data from Lake Constance, West Germany, April-October 1975, confirm the importance of Cytophaga-Flavobacterium as polysaccharide-degrading heterotrophic bacteria. In littoral areas, epilimnic plate count maxima show little coincidence with algal maxima or with total carbohydrate concentration peaks. Cytophaga-Flavobacterium is the main taxonomic pectolytic flora group (97%). In pelagic areas at the end of August, Cytophaga-Flavobacterium are the most important polysaccharide degrader, reaching 23% of the pectolytic, 20% xylanolytic, and 18% amylolytic bacteria. In mixed cultures with polysaccharide-containing natural substrates (autoclaved algae) Cytophaga develops in succession after cocci and motile rod populations at 20C. Amylase and xylanase are produced by all populations, whereas pectinase and cellulase are detected only in presence of Cytophaga. At 5C, Cytophaga populations dominate from the beginning of the culture and all tested polysaccharidases are produced. The combined effect of substrate quality and temperature strongly influences microbial floral composition. Natural polysaccharide-containing substrates favor Cytophaga-Flavobacterium enrichment and corresponding hydrolytic enzymes. The main activities of this group are restricted to polymeric organic degradation, while easier substances are taken up by bacteria competing more effectively because of higher substrate affinities. High Cytophaga counts also indicate high polysaccharide degradation activities. (Danovich-Wisconsin)
W80-02502

HETEROTROPHIC CO2-FIXATION IN THE OBLIGATE METHANE-OXIDIZING STRAIN M 102 AND POSSIBLE ECOLOGICAL SIGNIFICANCE,
Max-Planck-Inst. fuer Limnologie zu Holstein (Germany, F.R.).
M. Naguib.
In: Proceedings, Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2238-2244. 4 Fig, 3 Tab, 15 Ref.

Descriptors: *Methane bacteria, *Carbon cycle, *Metabolism, *Organic compounds, *Photosynthesis, Temperature, Heterotrophy, Bacteria, Decomposing organic matter, Carbon, Cultures, Enzymes, Ecology, Growth rates, Biochemistry, Cycling nutrients, Animal physiology, Laboratory tests.

A laboratory investigation shows that methylotroph growth and multipilication takes place under favorable stratified conditions, aerobically, and with specific C-1 substrate; in a thermally startified lake, this occurs at the metalimnion/hypolimnion interface. Even in the oxygen-free hypolimnion, a non-growth methylotroph medium, CO2-fixation occurs. During full circulation periods, organisms are vertically distributed in the water column. C-1 substrate experimental preference shows the sequences Ch30H, CH4/HCHO. Introducing CH4 (methane) and CH30H simultaneously exhibits summation of separate CO2-fixation intensities. According to peak height and area, methanol is preferentially taken up first, followed by methane. Methanol preference is ecologically interesting insofar as methanol is not only the first methane oxidation product but also an anaerobic pectin degradation product normally present in sediments. Although Strain M 102 does not grow or multiply in absolute methane environments without oxygen. CO2-fixation takes place under aerobic and anaerobic conditions. Strain M 102 CO2-fixation does not occur without the oxidizable substrate methane. In general, C-1 substrate, especially methane and definitely methanol, are always present in eutrophic lakes in appreciable concentrations to allow continuous CO2-fixation by methylotrophs. Specific CO2-fixation is most intensive at the beginning of the logarithmic growth phase and declines rapidly after that. CO2-fixation intensities decrease at 4C to one-third values at 20C. (Danovich-Wisconsin)

W80-02503

METABOLIC ACTIVITY OF BACTERIA IN THE RIVER DANUBE IN A YEAR CYCLE,
Institute of Experimental Biology and Ecology, Bratislava (Czechoslovakia).
I. Daubner, and B. Trzilova.
In: Proceedings, Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2245-2248. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *Bacteria, *Heterotrophy, *Danube River, Austria, *Oxygen requirements, *Rivers, *Water quality, Oxygen, Analytical techniques, Culture, On-site tests, Water temperature, Water pollution, Environmental effects, Metabolism, Growth rates, Population, Enzymes, Oxygenation, Self-purification, Microorganisms, Annual, Seasonal.

Different utilization values of various organic substrates by heterotrophic bacteria are caused by physical and chemical water properties and by microflora composition; on the other hand, results are also influenced by analytical techniques. Heterotrophic bacteria metabolic activity in an Austrians segment of the Danube River, April 1976-March 1977, was measured by the Donderski and Trzilova method, which allows determination from bacteria directly isolated from water without errors caused by culture multiplication. Total microbe numbers ranged 190,000-6 million/ml. Heterotrophic bacteria numbers ranged 6,400-23,000/ml with a peak in November due to effects of the beet sugar working season. Heterotrophic activity on all substrates is not affected by the beet sugar season (October-December) when the river is enormously enriched by organic matter. Heterotrophic bacteria numbers do not correlate with metabolic activity. All substrates are more intensively used in spring. Glucose and xylose utilization curves are similar to each other; serine and pyruvate sodium pyruvate, one important substance in bacteria metabolic pathways. Oxygen consumption ranges from 70 (January) to 500 micro l (June). Next-highest values are obtained by amino acid serine substrates, followed by glucose and xylose. Glucose and xylose negatively correlate with water temperature, while their relationship to organic matter and BOD is positive. Serine and sodium pyruvate utilization more closely correlate with water temperature. (Danovich-Wisconsin)
W80-02504

GLUCOSE CONCENTRATIONS AND HETEROTROPHIC ACTIVITY IN LAKE KINNERET,
Israel Oceanographic and Limnological Research Ltd., Tiberias.
B. Z. Cavari, G. Phelps, and O. Hadas.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2249-2254. 2 Tab, 21 Ref.

Descriptors: *Lake Kinneret, Israel, *Heterotrophy, *Bacteria, *Analytical techniques, *Nutrient kinetics, *Turnovers, Algae, Enzyme, Metabolism, Kinetics, Carbon, Nutrients, Cycling nutrients, Nutrient requirements, Population, Bioassay, Respiration, Turnovers, Depth, Phytoplankton.

Natural glucose concentration, determined biweekly at different depths in a central 42 m area of Lake Kinneret, Israel October 1976-June 1977 fluctuates only slightly around 36.3 micro g/l, although concentrations vary between 7-110 micro g/l. Using an enzymatic glucose assay technique developed by Cavari and Phelps, high heterotrophic activity (1 micro g/l/h) was observed in samples taken at 0,3, and 10 m in October-November and at all depths in May-June. During September-November high non-Pyrrhophyta biomass occurs (14.0-20.2 g/sq m) compared to December-January values (4.2-2.7 g/sq m). Uptake rates correlate with phytoplankton abundance explaining high glucose rates in the photic zone (October-November). During May-June, when massive Peridinium deaths occur, heterotrophic activity increases are observed at all depths due to dead Peridinium cells sinking into deeper waters and sediment layers. Glucose turnover times range 16-625 hrs. During October-December turnover time is shorter in upper layers than in lower layers; in January-February when the lake is completely mixed, it is almost the same in the entire water column. Turnover time is again shorter in upper layers in March; short times are probably due to bacterial activity accompanying non-Pyrrophyta algae. In May-June the situation is opposite with longer turnover times in upper layers due to the breakdown of dead Peridinium cells causing shorter times in lower layers. (Danovich-Wisconsin)
W80-02505

CHANGES IN PLANKTONIC MICROBIAL POPULATIONS - AN ANALYSIS BY SCANNING ELECTRON MICROSCOPE,
Max-Planck-Inst. fuer Limnologie zu Holstein (Germany, F.R.).
C. Krambeck.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2255-2259. 3 Fig, 6 Ref.

Descriptors: *Bacteria, *Algae, *Population, *Biomass, *Electron microscopy, *Plussee, West Germany, Nutrients, Analytical techniques, Microorganisms, Growth rates, Diurnal, Biorhythms, Distribution, Light, Environmental effects, Animal physiology.

Scanning electron microscope results of planktonic communities of microorganisms in waters of Plussee, West Germany April-July 1976, show that bacterial populations react quickly to alterations in substrate supply by algae, explaining daily synchronizations which correspond to light dependent, algal excretion rhythms. Bacterial populations depend on algal physiological conditions as well as species composition. Bacterial longer-dividing stages increase and shorter ones decrease from sunrise until 0940 hrs which reveals a slower division at 0940 hrs and faster division at sunrise. The percentage of dividing stages is 7% at sunrise and only 4-5% during other light periods; moreover, tendencies towards more big and long dividing stages occurs in afternoon and sunset samples. Width is also more typical than length for a given bacterium. Bacterial biomass exhibit two maxima; one on 1 May after collapse of Chrysochromulina parva bloom. The second occurs from 15 June-17 July, following a significant algal biomass increase due to an Aphanizomenon bloom. In both cases width spectra appear shorter than at low bacterial number periods. Variations in width spectra show selective and physiological bacterial population reactions to environmental changes such as substrate supply and temperature. Mean bacterial volume per cell is 0.04-0.13 cu microns. Bacterial volume/ml lake water reaches 1% algal biomass; therefore, bacteria are not considered a significant nutrient pool. (Danovich-Wisconsin)
W80-02506

BACTERIA, BACTERIAL ACTIVITIES, AND UPTAKE KINETICS IN SURFICIAL SEDIMENTS OF A SMALL EUTROPHICATED MOUNTAIN LAKE,
Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.).
C. Steinberg.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2260-2263. 4 Fig, 6 Ref.

Descriptors: *Bacteria, *Sediments, *Kinetics, *Spitzingsee, West Germany, Eutrophication, Alpine, Mountains, Lakes, Walchensee, West Germany, Biomass, Littoral, Population, Metabolism, Photosynthesis, Photosynthetic bacteria, Aerobic bacteria, Anaerobic bacteria, Biochemistry.

This paper discusses the structural analysis of sediment bacterial populations in Spitzingsee, a small eutrophicated mountain lake in West Germany. Samples were collected 23 September 1976. Specific sediment weight varied 1.12-1.17 g/ml fresh weight (fs). Sediment in the greatest influent delta contains more minerals; dry weight was 0.61 g/ml instead of 0.22-0.28 g/ml at other sites and ignition residue was 0.56 g/ml instead of normal values 0.19-0.24 g/ml. All other sites also contained sediments rich in sulfides and anaerobic. Highest surficial bacteria numbers were 4.05-4.87 billion/g fs whereas numbers in littoral sediments were 1.06-1.97 billion/g fs. Anaerobic glucose uptake (V-max) in profundal sediments was 100 micro g/kg h, whereas littoral sediments utilize 300 micro g/kg h. C02 fixation does not show a particular distribution pattern. Anaerobic and aerobic activities are similar, ranging 12-24 mg C/kg h. Bacteria at the greatest influent delta fix the largest C02 quantities both anaerobically (73 mg C/kg h) and aerobically (88 mg C/kg h); this is due to lake shallowness and inorganic and organic allochthonous inputs. Thus, sediment bacteria adapt to relatively high nutrient concentrations. BOD values range 1.6-11.7 g 02/l 5d; mean DHA value is 2.8 mg H/10g 24h. Bacterial data is also compared to earlier investigations at Walchensee, a mesoproductive mountain lake. (Danovich-Wisconsin)
W80-02507

SPATIAL AND TEMPORAL DISTRIBUTION IN A MEROMICTIC KARSTIC LAKE BASIN: RELATIONSHIPS WITH PHYSIOCHEMICAL PARAMETERS AND ZOOPLANKTON,
Universidad Autonoma de Barcelona (Spain). Dept. of Microbiology.
R. Guerrero, C. Abella, and M. R. Miracle.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2264-2271. 4 Fig, 3 Tab, 9 Ref.

Descriptors: *Bacteria, *Lake Banyoles, Spain, *Distribution, *Meromixis, *Physicochemical properties, *Turnovers, Rotifers, Zooplankton, Ecological distribution, Distribution patterns, Microorganisms, Population, Biomass, Anaerobic bacteria, Sulfur bacteria, Spatial distribution, Ecology, Sediments, Chemical properties, Turnovers, Water circulation, Environmental gradient, Stratification.

Bacterial biomass in a meromictic basin of Banyoles Lake, northeast Spain, varies 0.02 mg/l at 1 m, 0.10 mg/l (15 m), 0.87 mg/l (22m m), to 975 mg/l (25m) in studies conducted December 1976-July 1977. Banyoles (106 ha surface area) undergoes complete spring and fall overturns; however, one lateral 7.5 ha basin (basin III), separated from the main water by 5 m shallows and wind-protected, exhibits permanent meromixis. Basin III is stratifed into three zones: A marked chemocline occurs at 18 m. Mixing occurs above this; below 18 m, water has a much higher conductivity and sulfide concentration, and is completely anoxic. A third zone is a soft, watery mud, or soft sediment, below 25 m which reaches 100 m deep in the central basin area. Bacterial vertical distribution shows important differences between the three zones. Bacterial biomass in mixolimnion layers fluctuates according to temperature, mixing, and primary production. Biomass in winter is relatively low (0.1 mg/l) and increases in early spring (3 mg/l). Monimolimnion layers are affected by upper layer productivity; values range 0.5-10 mg/l. In upper soft sediment layers, bacterial biomass is always extremely high (1-4 g/l), due to organic matter enrichment. Mud layer physicochemical and biological conditions are the most stable year round. Zooplankton vertical distribution and bacterial total numbers are inversely related near the chemocline, due to rotifer (Dilinus, Anuaeropsis) and copepod nauplii feeding on bacteria. (Danovich-Wisconsin)
W80-02508

SUSPENDED AND ATTACHED MICROORGANISMS IN A POLLUTED RIVER,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
V. Straskrabova, P. Puncochar, B. Bojanovski, and J. Fuksa.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2278-2283. 2 Fig, 4 Tab, 18 Ref.

Descriptors: *Bacteria, *Biomass, *Water pollution, *Aquatic microorganisms, *Blankton, *Slime, *Sazava River, Czechoslovakia, Growth rates, Habitats, Water pollution sources, Coliforms, Microorganisms, Sewage effluents, Sewage disposal, Sewage bacteria, Environmental effects, Drifting(Aquatic), Suspended load, Sessile algae, Scum.

Both total biomass and ratio between bacteria groups are more strongly related to distance from pollution input for attached forms than for suspended microorganisms in the Sazava River Czechoslovakia, in a March-November 1975 study. Attached (slime) and suspended (free water) biomass of microorganisms were studied in Sazava, a 220 km river with 4,350 sq km drainage area, 23 cu m/sec mean discharge, and 20-30 cm/sec flow velocity. Two sampling points were regularly observed: one below an untreated municipal sewage discharge from Tynec (3000 inhabitants) and the other 10 km lower with no further greater pollution input. A total of 210 coliform bacteria strains were identified from the water and slime; half were Enterobacteriaceae. Quantitative differences between polluted and less-polluted sampling stations are more pronounced in slime than free water. Enteric bacteria slime growth in total standing crop is higher at the more-polluted station. Qualitative coliform bacteria composition differences are not noted between sampling stations or between water and attached slime. Percentage of suspended component in the total standing crop (per unit water surface) is 5-15% on more polluted and 10-80% on less polluted sampling stations. Specific glucose uptake activity of attached bacteria mixed in water is higher than that of planktonic bacteria. (Danovich-Wisconsin)
W80-02510

STRATIFICATION IN NATURAL POPULATIONS OF BLOOMFORMING BLUE-GREEN ALGAE,
Freshwater Biological Association, Ambleside, (England).
C. S. Reynolds.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2285-2292. 5 Fig, 34 Ref.

Descriptors: *Cyanophyta, *Algae, *Biomass, *Distribution, *Water temperature, *Stratification, *Lakes, Eutrophication, Growth rates, United Kingdom, Anabaena, Spatial distribution, Ecological distribution, Light, Light intensity, Depth, Euphotic zone, Epilimnion, Thermal stratification, Water circulation, Population.

Phytoplankton studies in three British lakes reveal that bloom-forming blue-green algal stratification is a predictable consequence of efficient buoyancy control, whenever the combination of thermally stable water layers and relatively high light penetration permits it; the phenomenon is rare since lakes in which this combination occurs are usually not dominated by bloom-forming species. Algal stratification is reported from eutrophic calcareous lakes Crose Mere (15.2 ha area, 9.3 m maximum depth) and Rostherne Mere, (48.7 ha area, 30 m maximum depth), and from an experimental Lund Tube (1630 sq m area, 11.9 m maximum depth) in Blelham Tarn, a soft-watered lake. May 1975, a 4.5 m depth Anabaena circinalis maximum was observed in Crose Mere. On 20 May, vertical heterogeneity was apparent with a significant maximum (12,000 cells/ml) at 3-6.5 m depth. By 28 May, the maximum increased to 20,000 cells/ml and moved above 5 m. Algal stratification disappeared by 4 June, with most algae distributed throughout the enlarged epilimnion. Microcystis aeruginosa depth maximum occurred in Rostherne Mere; an Aphanizomenon flos-aquae vertical bloom occurred in Blelham. Development depends upon stable thermal stratification and, to some extent, a thermal microstratification in the epilimnion. Algal stratification is temporary, never exceeding one month's duration; increased turbulence in algal depth maxima layers is largely responsible for its disruption. (Danovich-Wisconsin)
W80-02511

NITROGEN LIMITATION OF GROWTH AND GAS VACULATION IN OSCILLATORIA RUBESCENS,
New York State Univ., Purchase. Div. of Natural Sciences.
A. R. Klemer.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2293-2297. 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Cyanophyta, *Limiting factors, *Growth rates, *Cytological studies, *Plant morphology, Cultures, Nitrogen, Plant physiology, Metabolism, Light, Light intensity, Algae, Nutrient requirements, Osmotic pressure, Turgidity, Turbidity, Nutrients.

Nutrient limitation experiments on Oscillatoria rubescens reveal no evidence that gas vacuolation increases with N-limited growth. In N-limited continuous cultures, relative gas vacuolation decreases as N becomes less available after a step-down in dilution rate; even in darkness, gas vaculation does not increase without NH4 enrichment. In continous-culture experiments, algal nutritional status is affected by step-function changes in dilution rate; a step-down from 0.29-0.18/day occurs on day 2 and a step-up back to 0.29/day on day 12 occurs. Shifts to lower dilution rates are followed by parallel declines in relative gas vacuolation and N sufficiency and by peaks in filament concentration. Macroscopic changes in algal buoyancy and pigment also take place. Step-up produces almost exact opposite results with peaks in relative gas vacuolation and N sufficiency and filament concentration decreases. Thus, gas vacuolation varies directly with algal N nutritional status and inversely with filament concentration. However, evidence that N limits growth and gas vacuolation simultaneously does not prove the latter is unaffected by growth rate. After the step-up in dilution rate, gas vacuolation increases before cell division increases; this is due to enhanced N assimilation by N N-starved cells and/or to a reduction in turgor pressure associated with an increased supply of limiting nutrient. (Danovich-Wisconsin)
W80-02512

DAILY RHYTHM OF REGULATION OF POLYPHOSPHATE METABOLISM IN AN ALGAL BLOOM OF OSCILLATORIA REDEKEI,
Universitaet des Saarlandes, Saarbruecken (Germany, F.R.).
U. Zaiss.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, p 2298-2301, 1978. 2 Fig, 6 Ref.

Descriptors: *Cyanophyta, *Plussee, West Germany, *Diurnal, *Metabolism, *Phosphorus compounds, Eutrophication, Phosphorus, Phosphates, Plankton, Cytological studies, Plant physiology, Proteins, Enzymes, Photosynthesis, Carbon dioxide, Orthophosphate, Nutrients, Nutrient requirements, Fluctuations, Nocturnal, Time.

Oscillatoria redekei bloom metabolism in Plussee, West Germany, measured 19-20 June 1975, exhibits high activities of polyphosphate kinase (PPK) and ratio of single polyphosphate fractions (A,B,C,D), indicating that phosphate is growth limiting. Plankton in epilimnion layers consisted of 70.8% Cyanophyceae; O. rededei made up 38.7%. Zooplankton were fairly numerous, especially at night (26.7%). O. redekei population was in the dying phase since it comprised 75% of the Cyanophyceae 48 hrs previous to the study. This is confirmed by continual increases in dissolved protein (4-7 micro g/ml). Particulate phosphate concentration is minimum at midnight, coinciding with maximum orthophosphate concentration. Orthophosphate comprises an extremely small fraction of epilimnion phosphate content; mean concentration is 2.2 micro g/l. Dissolved organic phosphate increases continually. Average PPK-specific activity is 300 U/mg protein. Fluctuations of individual polyphosphate fractions resemble those of the whole fraction. Mean ratio (A+B):(C+D) is 23:77. Polyphosphate pool fluctuations are exactly opposite those of metabolic activity, which are indicated by phosphorylated photosynthetic product levels. When photosynthetic activity is high, phosphate is supplied from internal stores and during the night, it is contributed to phosphate depots. CO2 deficiency at noon causes temporary polyphosphate formation. (Danovich-Wisconsin)
W80-02513

ON NITRATE UPTAKE BY OSCILLATORIA AGARDHII,
Amsterdam Univ. (Netherlands). Lab. for Microbiology.
W. Zevenboom, and L. R. Mur.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2302-2307. 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Nitrates, *Nutrient kinetics, *Limiting factors, *Light, *Scillatoria agardhii, *Phosphates, Cyanophyta, Algae, Kinetics, Cycling nutrients, Nutrient requirements, Cultures, Michaelis-Menten equations, Cytological studies, Laboratory tests, Lake Wolderwijd, Netherlands, Plant physiology, Population, Growth rates, Light intensity.

Studies of the influence of nitrate (N)-, phosphate (P)-, and light-limitation on nitrate uptake by the blue-green alga Oscillatoria agardhii, grown in chemostat, show that half-saturation constant (K-s) and maximum nitrate uptake capacity (V-max) values act as physiological indicators for N-, P- or light-limited phytoplankton growth. However, additional information about physiological data, such as pigmentation and P-uptake kinetics are neede. V-max for N- and P-limited cultures were almost identical and relatively high (0.82 micro mol/mg h for N-limitation, 0.76 micro mol/mg h for P-limitation) compared with V- max values for light-limited culture (0.10 micro mol/mg h). At low growth rates, V-max for N-limited cells exceeded the specific uptake rate; however, at higher growth rates the discrepancy decreased. P-limitation simultaneously restricts nitrate uptake. N-limited and light-limited chemostat cultures at low growth rates, express low K-s values, while K-s is high in P-limited chemostat cultures. The physiological state of natural populations in Lake Wolderwijd, The Netherlands, during summer was determined by comparing lake data with laboratory cultures. Although lake nitrate concentrations were low, light-limitation rather than N-limitation probably prevailed, due to low V-max sample values. (Danovich-Wisconsin)
W80-02514

GROWTH OF SCENEDESMUS PROTUBERANS FRITSCH IN PHOSPHORUS-LIMITED CULTURES,
Institute of Limnology, Nieuwersluis (Netherlands).
H. J. Gons, D. Barug, H. Goossens, and J. G. Loogman.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2308-2313. 4 Fig, 17 Ref.

Descriptors: *Chlorophyta, *Phosphorus, *Limiting factors, *Growth rates, *Cytological studies, *Nutrient kinetics, Algae, Succession, Cultures, Laboratory tests, Cycling nutrients, Nutrients, Kinetics, Michaelis-Menten equations, Curves, Chlorophyll, Phosphates, Biomass, Light, Light intensity, Eutrophication.

Phosphorus-limited growth experiments on the green alga Scenedesmus show that biomass yield on phosphate changes markedly with growth rate. These changes correlate with growth-rate dependent intracellular concentrations of phosphorus compounds which are extractable with cold TCA and with only hot TCA; remaining fractions are much less affected. Extracellular phosphorus concentration with steady state growth at half the maximum rate is 6 micro g/l. Scenedesmus protruberans fritsch was grown on a mineral medium with an inorganic phosphate growth-limiting concentration, at 20 C and with continuous light, in chemostats. Particle number and total particle

volume decline with increasing growth rate; these result from changing intracellular phosphorus concentration. Growth rate and extracellular phosphorus in any fraction nor total phosphorus intracellular content are hyperbolically related to growth rate; these relationships are linear. Secendesmus chlorophyll content varies with growth rate; values are much lower than with light-limited cultures. Carenoids do not shift relative to chlorophylls. Algal succession in freshwater from diatoms to green algae to blue-green algae is explained by the following hypothesis; excessive phosphate loading acts indirectly in benefitting blue-green algae by causing changes in light distribution in water; this gives Oscillatoria a growth advantage over Scenedesmus. (Danovich-Wisconsin)
W80-02515

A MODEL OF THE SUCCESSION FROM GREEN TO BLUE-GREEN ALGAE BASED ON LIGHT LIMITATION,
Amsterdam Univ. (Netherlands) Lab. for Microbiology.
L. R. Mur, and R. O. Beijdorf.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2314-2321. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Computer models, *Succession, *Algae, *Simulation analysis, *Light intensity, *Cyanophyta, *Chlorophyta, Mathematical models, Model studies, Eutrophication, Growth rates, Biomass, Population, Computers, Dynamic programming, Light, Limiting factors, Phosphates, Water properties.

A model simulating light-and phosphate-dependent growth of green and blue-green algae confirms that energy supply together with algal energy-use efficiency are the important factors of succession from green to blue-green algae. Results confirm that Oscillatoria agardhii blooms are regulated by factors which define light conditions, mainly incident light intensity, suspended detritus, algal biomass, and water depth. The Monod equation is taken as a basis for growth. Model starting conditions include: 160 cm depth, 1 mg P.l phosphage concentration, 1 mg/l green algal concentration, 1 mg/l blue-green algal concentration, and 0.02/cm extinction of suspended materials and water. The 160 m water column is differentiated into six 10 cm layers. Layer 0 light intensity is initially too high to allow maximal green algal growth rate. After 12 days, average light intensity decreases so that green algae reach maximal growth rates in this layer. Shading diminishes growth in layers 3-6. Light distribution changes influence blue-green algae differently: average light intensity in layer 0 is always too high to permit blue-green algal growth and light conditions in deeper layers (3-6) are initially favorable. After 10-17 days, positive growth is maintained in layers 1-3. By blue-green algal growth in these layers and low energy consumption of blue-green algae in the dark, average biomass increases, ultimately resulting in a succession from green to blue-green algae. During the whole time, phosphate is available in all water layers. (Danovich-Wisconsin)
W80-02516

AN IMPROVED METHOD FOR MEASURING IRRADIANCE IN ALGAL CULTURES,
Amsterdam Univ. (Netherlands). Lab. for Microbiology.
J. G. Loogman, and L. van Liere.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2322-2328. 10 Fig, 6 Ref.

Descriptors: *Algae, *Cultures, *Light intensity, *Laboratory equipment, *Light penetration, *Analytical techniques, Light equipment, Measurement, Calibrations, Testing, Microenvironment, Cyanophyta, Chlorophyta, Population, Density, Suspension, Microbiology.

Photodiodes can be used to measure irradiance in algal cultures; they are sufficiently small to be placed in culture vessels, are cosine-corrected, have an opening angle 2 times 90 degrees, and can determine light distributions within culture vessels. When filters are not used, significant deviations from the ideal cosine-correction occur; however, with filter use an ideal cosin-correction is achieved. Photodiodes are linear up to 160 W/sq m. Average incident irradiance is linearly proportional to the adjusted lamp intensity, expressed by reference current, as measured with the selenium cell. Light distributions were determined in culture vessels containing Oscillatoria agardhii suspensions of various optical densities at 720 nm, in a vessel containing clear water and in vessels containing Scenedesmus protuberans suspensions. In the clear water vessel, despite increasing distance from the wall and thus from the lamp, no light attenuation takes place. In suspensions up to 0.2 O.D., organisms are subject to identical light conditions in all vessel sections. Light scattering by filamentous organisms differs from that by spherical organisms. Even at 2 O.D., not all incident irradiance is absorbed; the difference must be taken into account when calculating growth efficiencies in dense cultures. (Danovich-Wisconsin)
W80-02517

GROWTH AND NUTRIENT UPTAKE IN OUTDOOR MASS CULTURES OF SCENEDESMUS ACUTUS,
Ghent Rijksuniversiteit (Belgium). Facultiet Landouwwetenschappen.
H. R. Paelinck, and J. DeMaeseneer.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2329-2334, 2 Fig, 4 Tab, 5 Ref.

Descriptors: *Cultures, *Nutrients, *Kinetics, *Growth rates, *Scenedesmus, *On-site investigations, Biomass, Chlorophyta, Nutrient requirements, Primary productivity, Nitrogen, Phosphorus, Light, Light intensity, Carbon, Diurnal, Nocturnal, Limiting factors, Mathematical models.

Experiments on the green alga Scenedesmus acutus grown in raceways during summer 1976 show that Paelinck and DeMaeseneer's mathematical model describing nutrient uptake can be used under field conditions with some restrictions. When cultures were renewed in the morning a -5% correction is compulsory for N and -10% for P. However, when cultures were renewed in the evening and additional correction of -5% for N and -10% for P was necessary. Outdoor experiments took place in raceways with 1.68 sq m surface area and 250 l culture volume. In reference cultures nutrients were given in excess whereas in remaining raceways N and P amounts were progressively reduced. DW production averaged 15.52 g/sq m in reference cultures (range 4.35-23.03 g/sq m). Average daily total solar insolation was 520 cal/sq cm d (89-686 cal/sq cm d). Light utilization efficiency varies 0.88-2.86% with 1.82% average. N-uptake experienced deviations of +1.83% to -10.5%; P-uptake differed from +7.15% to -15.81%. In the course of the day, progressively less N and P were taken up. In nutrient deficient cultures the same influences operate; however, maximum N-uptake deviation (-10.02%) occurred in morning. Deviations were the same magnitude in cultures with different retention times. Average light utilization efficiency diminished at higher retention times. (Danovich-Wisconsin)
W80-02518

INFLUENCES EXERTED BY SALINITY ON A NORFOLK BROADS STRAIN OF PRYMNESIUM PARVUM (CARTER),
University of East Anglia, Norwich (England). School of Environmental Science.
P. Holdway.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2336-2340, 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Algae, *Israel, *Norfolk, United Kingdom, *Growth rates, *Salt tolerance, *Salinity, Environmental effects, Calcium, Phosphates, Saline water, Brackish water, Hardness(water), Chemical properties, Salts, Metabolism, Halophytes, Population, Cultures, Laboratory tests, Cytological studies.

Salinity experiments on alga Prymnesium parvum obtained from Israel and from one of the Thurne Broads (shallow lakes linked by rivers in Norfolk England) show that both strains act similarly to low salinities, in terms of population growth and cell size. Dissimilarities are noted in pigment content and ichthyotoxic activity; cells from the English lakes tend to exert greater ichthyotoxicity than Israeli algae. Toxin produced by P. parvum, an euryhaline chrysomonad, has caused extensive fish kills in European and Israeli brackish waters. Both populations increase initially in salinities 22.46 and 11.23 parts per thousand (ppt). Populations grow after an initial decline at 8.42 and 5.62 ppt, whereas cells die at 2.81 and 1.12 ppt salinity. Cells grown in SM media show decreased growth rates at high (54 mg/l) calcium levels. Phosphate additions do not affect subsequent population growth. Salinity does not influence chlorophyll-a content per cell. However, chlorophyll-a; carotenoid ratios are 1.7-2.7 (English), compared with 1.2-1.4 for Israeli strains under all salinities. Broad cells possess greater ichthyotoxic activity; when grown in 5.62 ppt salinity media, in similar population densities as Israeli algae, they produce 75 ITU, thus exceeding the maximal Israeli cell toxin output. (Danovich-Wisconsin)
W80-02519

FACTOR ANALYSIS OF TEMPORAL AND SPATIAL PATTERNS OF MULTICELLULAR GREEN FRESHWATER ALGAE,
Vrije Univ., Amsterdam (Netherlands). Biological Lab.
H. Hillebrand.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, p 2341-2346,3 Fig, 9 Ref.

Descriptors: *Systematics, *Algae, *Distribution, *Ecotypes, *Botshol, The Netherlands, *Correlation analysis, *Factor analysis, Distribution patterns, Ecological distribution, Chlorophyta, Seasonal, Spatial distribution, Mathematical studies, Analytical techniques, Floating plants, Plant groups, Aquatic algae.

Factor analysis helps to describe periodicity and distribution of multicellular green algae in the Netherlands eutrophic lake area, Botshol; objective methods prove the existence of species groups, characteristic for particular periods of the year. Botshol is a marshland intersected by numerous ditches and ponds; Grote Wije, a small lake, is located on the SW part. Using factor analysis and correlation analysis, temperal and spatial species groups are established; comparison reveals 12 ecological species groups, delineated temporally and spatially. The basic scheme includes: (1) Epiphytic growths, dominated by Cladophera glomerata; (2) Growths, mainly epiphytes, in reed zones along various water bodies; (3) Floating algal masses in small ponds with Stratiotes aloides vegetation; (4) Floating algae in small isolated pools and in a small pond; and (5) Rhizoclonium growths. At a given sampling station, up to three groups can be found during one year. The summer group is of greater relative importance than other seasonal groups. Marked differences do not characterize perennial and annual species groups: most species are found occasionally in their period of expected absence. (Danovich-Wisconsin)
W80-02520

EXPERIMENTAL EFFECTS OF ISOETES LACUSTRIS L. ON THE DISTRIBUTION OF EH, PH, FE AND MN IN LAKE SEDIMENT,
Ulm Univ., (Germany, F.R.).
U. Tessenow, and Y. Baynes.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2358-2362, 4 Fig, 6 Ref.

Descriptors: *Lake sediments, *Soil chemical properties, *Rooted aquatic plants, *Soil-water-

plant relationships, *Metals, *Accumulation, *Feldsee, West Germany, Sediments, Sediment-water interfaces, Iron, Manganese, Hydrogen ion concentration, Submerged plants, Oxidation-reduction potential, Root zone, Soil chemistry, Oxygen, Distribution, Laboratory tests, Interstitial water.

Long-term laboratory experiments with Isoetes lacustris and sublittoral lake sediment from Feldsee, West Germany, show that oxygen release from Isoetes roots in the sediment causes iron (Fe) and manganese (Mn) oxides accumulation. In control columns, pH (7.0) and EH (50-150 mv) are relatively constant except for the topmost layer. In sediments influenced by Isoetes, pH is markedly less (4.8) and EH is correspondingly greater (500 mV) down to 15 cm depth. Steep gradients are found directly below living Isoetes roots 15-18 cm down. In lower layers (20-25 cm) pH and EH of both control and Isoetes sediments are equal. In controls, Fe and Mn gradients start in uppermost layers, whereas the Isoetes present, concentrations drastically decrease down to 15 cm. Gradients start below this level and rise steeply. Final Fe and Mn concentrations below 20 cm are identical with controls. In experiments, with Isoetes, owing to oxygen released from plant roots, the oxidized upper sediment layer increases in depth to 15 cm. EH, pH, and interstitial Fe and Mn water concentrations are displaced towards 15-20 cm (downwards). Solid-phase Fe and Mn maxima accumulations sharply define lower limits of the oxidized layer. Direct redoxchamical effects of Isoetes on lake and experimental sediments are found to 18-20 cm depth. In controls, Fe and Mn contents increase in uppermost sediment layers to the cost of sediment beneath. (Danovich-Wisconsin)
W80-02521

RAPID EXCHANGE OF OXYGEN BETWEEN PLANT AND WATER,
Freshwater Biological Association, Wareham (England). River Lab.
D. F. Westlake.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2363-2367, 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Metabolism, *Aquatic plants, *Oxygen, *Lacunae, *Plant morphology, *Plant physiology, Gases, Aeration, Light intensity, Water balance, Oxygen demand, Microbiology, Diffusion, Equilibrium, Time, Flow, Oxygen requirements, Photosynthesis, Respiration.

Under stirred or flowing conditions, constant-oxygen rates of change are attained after 4-20 min when plants possess lacunae and quicker when they lack them. This paper describes experiments on rates of oxygen change in water flowing past aquatic plants. specifically the amount of time it takes to reach and maintain steady-state. Plants include Myriophyllum spicatum and Vallisneria americana with lacunae and Fontinalis antipyretica and Cladophora without lacunae. Detectable lags are rare whenever plants are darkened; however, in one experiment with Vallisneria, lags were 4-10 min. Lag times after illumination are significantly shorter for plants without lacunae (2 min) than for those with them (9 min). Constant rates are rarely maintained for more than 20-30 min. In 'saw-tooth' experiments the same high constant rate could be repeated and maintained over 1 h by replacing the water. Rates 2-10 mg 02/g d wt/h are considered rapid. Extracted gas volumes were usually 10-15% of total plant volume. Results for Myriophyllum experiments in light and aerated water were: 3.31 ml gas containing 21.9% oxygen from 20.4 g fr wt. Lacunae in illuminated plants in air-saturated water contain 23% oxygen; internal oxygen concentrations, higher than external levels, fall rapidly when photosynthesis rates decrease. Therefore, resistance to outward diffusion is not high. (Danovich-Wisconsin)
W80-02522

IMPACT OF THE FRESHWATER SPONGE SPONGILLA LACUSTRIS ON A SPHAGNUM BOG-POND,
Dartmouth Coll., Hanover, NH. Dept. of Biological Sciences.
T. M. Frost.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; vol 20, Part 4, 1978, p 2368-2371, 1 Tab, 4 Ref.

Descriptors: *Mud Pond(NH), *Aquatic animals, *Ecology, *Sponges, *Water purification, *Feeding rates, Growth rates, Distribution, Bogs, Environmental effects, Filters, Filtration, Water quality, Regression analysis, Turnovers, Suspended load, Suspended solids, Particle size, Diets, Foods, Metabolism.

Regression equations for Spongilla lacustris in Mud Pond, New Hampshire, March-October 1976, show that these sponges exhibit an average 0.83 ml/sec/g dwt of water cleared at 15.3 C. Thus the total pond sponge population, 148,000 g dwt, eats about 10.7 million 1/d. These are comparable to rates reported for zooplankton communities in bog and oligotrophic lakes. Therefore, in some freshwater systems, sponges significantly contribute to suspension feeding. Mud Pond, a Sphagnum bog-pond, has 5.5 ha surface area, 2.55 m maximum depth, and 1.36 m average depth. S. lacustris average standing crop is 2.67 g dwt/sq m in October. Sponge population is not distributed homogeneously; colonies are rare at depths greater than 1.7 m and also near very shallow areas. S. lacustris exhibits very high growth rates. Sponges implanted on rafts in May have an average 0.014 g dwt; by October sponges have an average 12.52 g dwt. Average feeding rates during laboratory experiments range 0.38-6.59 ml/sec/g dwt with a 2.04 mean. Calculated mean reeding rates for areas less than 1.75 m deep in Mud Pond are 1.46 (June), 1.50 (July), 1.42 (August), 1.19 (September) and 0.84 (October) ml/sec/g dwt. Due to changes in biomass, the percentage of water column cleared per day is 0.91 (June), 3.50 (July), 9.60 (August), 21.2 (September), and 23.1 (October). (Danovich-Wisconsin)
W80-02523

CONTRIBUTION OF ASEXUAL REPRODUCTION TO THE DISTRIBUTION OF TRICLAD FLATWORMS,
Lyon Univ. (France). Dept. of Biology.
E. Patte, and H. Persat.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2372-2377. 2 Fig, 2 Tab, 24 Ref.

Descriptors: *Ecology, *Asexual reproduction, *Sexual maturity, *Flatworms, Growth rates, Aquatic animals, Distribution, Reproduction, Animal physiology, Animal behavior, Worms, Turbellaria, Amby River(France), Herault River(France), Algeria, Adaptation, Population, Water temperature, Mortaility, Genetics.

Studies of triclads and sexually-reproducing flatworms from Algeria and southern France show that asexual reproduction extends the range of triclads toward warmer biotopes and affords a competitive superiority in r-selection cases. Despite genetic invariability, clones show some adaptation to their environment. Triclads were reared in fingerbowls at different temperatures under optimal food conditions and life-tables. Polycelis felina, a sexually-reproducing population, were collected from the Amby River, southeastern France. Fertile cocoons (0.0044) are only deposited in a narrow thermal range around 10 c, whereas fission occurs from 10-17.5 C and at higher rates (0.012-0.09). Genetic stocks of clones (Dugesia gonocephala) were obtained from Algeria and the Herault River in southern France. Variances due to temperature, clonee origin, and substrates were computed. Both clones responded in the same manner to substrate. Survival was significantly longer on losses (12.6 h) than with pebbles (8,8 h). Algerian clones surived longer (14.4 h) than French clones (7.7 h), demonstrating that ecophysiological diversity exists among D. gonocephala clones. Temperature-survival curves were statistically straight lines only from 31-34 C. Survival at 30 C was higher. Lethal temperature (24 h) was 31.0 C for the Algerian clone, 30.6 C for the French clone, and 28 C for D. gonocephala from the Amby River. (Danovich-Wisconsin)
W80-02524

REPRODUCTIVE STRATEGIES SHOWN BY FRESHWATER HIRUDINOIDEA,
Calgary Univ. (Alberta). Dept. of Biology.
R. W. Davies.
In: Proceeding: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; vol 20, Part 4, 1978, p 2378-2381. 1 Tab, 9 Ref.

Descriptors: *Leeches, *Reproduction, *Timing, *Lakes, *Alberta, Canada, *Animal behavior, Ecology, Invertebrates, Aquatic animals, Population, Adaptation, Animal physiology, Competition, Life history studies, Life cycles, Breeding, Speciation, Marion Lake, British Columbia, Newsome Pond, Alberta, Jail Pond, Alberta, Cairn Pond, Alberta, Canada.

This paper discusses leech population reproductive strategies in Canadian lakes: Helobdella stagnalis was studied in Marion Lake, Bristish Columbia and Newsome Pond, Alberta; Nephelopsis obscura was studied in Newsome and Jail Ponds, and Erpob punctata in Cairn ajd Jail Ponds, all semi-permanent ponds in Alberta. The most important reproductive factor fo H. stagnalis is temperature in terms of growning season length. Two generations of young are produced annally only if more that 2000 day-degrees occur between release of young and growth cessation. Alberta field and laboratory experiments indicate that where the growing season is short, second generation individuals do not survive. N. obscura in Alberta has two breeding periods, May-June and August-September. N. obscura weight ranges 170-500 mg. If the appropriate size is attained (150 mg) withing 12 months reproduction follows a simple annual cycle; if it is not reached within 12 months, reproduction is delayed. Jail and Cairn Ponds are geographically close and limnologically similar; E. punctata and N. obscura have very similar diets. Therefore, their reproductive strategy differences depend on interspecific competition. With N. obscura absent in Cairn, E. punctata reproduces over two years. In Jail Pond, with N. obscura competition, E. punctata produces young as soon and as rapidly as possible to utilize spring secondary production as soon as N. obscura. Thus in Cairn, E. punctata shows K-selection characteristics but in Jail, shows r-selection. (Danovich-Wisconsin)
W80-02525

FEEDING IN THE ROTIFER BRACHIONUS CALYCIFLORUS (III). DIRECT OBSERVATIONS ON THE EFFECTS OF FOOD TYPE, FOOD DENSITY, CHANGE IN FOOD TYPE AND STARVATION ON THE INCIDENCE OF PSEUDOTROCHAL SCREENING,
Dartmouth Coll., Hanover, NH. Dept. of Biological Sciences.
J. J. Gilbert, and P. L. Starkweather.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische Und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2382-2388. 3 Fig, 3 Tab, 6 Ref. NSF DEB 76-09768.

Descriptors: *Rotifers, *Algae, *Animal behavior, *Food habits, *Particle size, *Feeding rates, Aquatic animals, Foods, Diets, Digestion, Metabolism, Density, Size, Food abundance, Animal metabolism, Mode of action, Animal physiology, Predation, Ecology.

Laboratory experiments on the orientation of pseudotrochal cirri in rotifer exposed to various particle types and concentrations show that Brachionus calyciflorus and probably other rotifers do not ingest food items in proportion to their abundance and can control admission of particles into their buccal field. Pseudotrochal screening, and thus potential clearance rates and feeding efficiencies, are a function of particle type and particle density, and can be modified by previous feeding history. Rhodotorula, even at high densities, rarely induces screening while Euglena induces much screening at high densities and less screening at low densities.

Very small cells, such as Rhodotorual, are regularly taken into the buccal field, independent of density, while larger cell types are increasingly deflected away from the buccal field at high densities. Rotifers transferred from Rhodotorula to Euglena form pseudotrochal screens less than rotifers transferred from Euglena to Euglena. This difference persists 15 min after transfer. Starved individuals rarely form pseudotrochal screens. Screening responses are not simple reflexes and are significantly influenced by previous feeding history, such as whether or not they have been starved or acclimated to other particles. (Danovich-Wisconsin)
W80-02526

FEEDING IN THE ROTIFER BRACHIONUS CALYCIFLORUS IV. SELECTIVE FEEDING ON TRACER PARTICLES AS A FACTOR IN TROPHIC ECOLOGY IN AN IN SITU TECHNIQUE,
Dartmouth Coll., Hanover, NH. Dept. of Biological Sciences.
P. L. Starkweather, and J. J. Gilbert.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2389-2394. 1 Fig, 3 Tab, 18 Ref. NSF DEB 76-09768.

Descriptors: *Rotifers, *Food habits, *Tracers, *Yeasts, *Euglena, *Analytical techniques, *Indicators, *Laboratory tests, Food abundance, Diets, Aquatic animals, Animal behavior, Metabolism, Animal metabolism, Mode of action, Ecology, Animal phsiology, Particle size, Algae.

Brachionus calyciflorus, a pelagic rotifer, can select specific particle types from simple mixtures of suitable foods. However, in these laboratory experiments, no single tracer reliably indicates feeding activities on different particles. For Euglena-fed animals, clearance rates based on algal tracers are 3.49 micro 1/animal/hr. But clearance rates based on the yeast tracer are 13.85 micro 1/animal/hr. Testing with Rhodotorula-fed rotifers also shows that yeast gives significantly greater clearance rate estimates than when using Euglena. B. calyciflorus is also more efficient at collecting yeast than algae. Using Euglena as primary food, and testing both algal and yeast clearance simultaneously, yeast is removed at a significantly greater rate. Using the yeast tracer alone to estimate feeding results in a 160% overestimation in clearance and hourly Euglena rations. Of great interest for rotifer trophic ecology is the indication that feeding history affects food selectivity. With yeast as the primary food, yeast-cultured animals feed on Rhodotorula preferentially whereas Euglena-cultured rotifers prefer Euglena, even though they acclimated in similar suspensions for one hour. (Danovich-Wisconsin)
W80-02527

EFFECTS OF ALGAE AND PROTOZOANS ON THE DYNAMICS OF POLYARTHRA VULGARIS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
A. L. Buikema, Jr., J. D. Miller, and W. H. Yongue, Jr.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2395-2399. 4 Fig, 16 Ref.

Descriptors: *Rotifers, *Population, *Pandapus Pond,(VA), *Food abundance, *Animal physiology, *Animal behavior, Ecology, Biological communities, Algae, Protozoa, Reproduction, Fertility, Fecundity, Foods, Diets, Food habits, Productivity, Vitamins, Water temperature, Mountains competition.

Polyarthra vulgaris (rotifer) populations in Pandapas Pond, Virginia are influenced by: high temperatures (>23C) which affect survival and retard production; proper food availability; availability of soluble vitamins and ability to compete for them especially B-12; and antibiosis by various algae and protozoa. Pandapas Pond is a shallow impoundment located at 664.8 m altitude in Jefferson National Forest, with 32,376 sq m surface area, and 3 m maximum depth. Polyarthra numbers, in addition to characteristic spring and fall maxima, peak in late November-December. The highest density (1169/1) occurred in December when temperatures were 2.8C. Polyarthra feeds primarily on Dinobryon, especially D. sertularia and D. divergens, Cryptomonas erosa, and Chilomonas. Total euglenoid densities correlate with Polyarthra peaks when euglenoid densities exceed 200,000/ml. While Polyarthra rarely feeds on euglenoids, Polyarthra required soluble vitamin B-12 for successful egg production and hatching and euglenoids are B-12 indicators. The late fall Polyarthra peak corresponds with fall abscission of leaves; leachates from plant materials containing soluble vitamins are partially responsible for Polyarthra dynamics. Precipitous declines in Polyarthra populations in early August correspond to Eudorina blooms and temperatures in excess of 25C. In August and September, blue-green algal blooms inhibit Polyarthra. When Monas, Synura, Mallomonas and blue-green algae occur in large numbers, the percentage of Polyarthra females carrying eggs declines. (Danovich-Wisconsin)
W80-02528

INFLUENCE OF FLUCTUATING TEMPERATURE ON PLANKTON ROTIFERS. II. LABORATORY EXPERIMENTS,
Biological Station, Lunz am See (Austria).
A. Ruttner-Kolisko.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2400-2405, 6 Fig, 1 Tab, 6 Ref.

Descriptors: *Rotifers, *Temperature, *Life history studies, *Laboratory tests, Plankton, Reproduction, Cultures, Neusiedlersee, Austria, Growth rates, Asexual reproduction, Population, Clones, Standing crops, Thermal stress, Metabolism, Animal physiology.

Hexarthra fennica populations in exponential growth phase with all other environmental factors constant react to fluctuating temperature in agreement with theoretical models, temperature oscillations tend to shorten egg development time and to prolong the interval between eggs. At constant temperature, deposited egg development time, dependent solely on temperature, deviates only minimally from calculated mean values for the whole female life span. Average clone growth rate is 60% during the day and 20% at night, in full agreement with theoretical schedules postulating a 3:1 oscillating egg deposition ratio. However, Hexarthra populations display identical gradients for growth curves at constant and fluctuating temperatures; this is inconsistent with theoretical expectations and with results of other recent studies. This result may be connected with experiments carried out in unrestricted environments rather than the steady-state situation used by others in literature data. Hexarthra is a planktonic rotifer originating from Neusiedlersee, Austria. Laboratory cultures were acclimatized for three days to 24-hour temperature oscillations of 10 C (18 C at 2 hr, 28 C at 14 hr) under constant light conditions. (Danovich-Wisconsin)
W80-02529

GROWTH RATES OF DREISSENA POLYMORPHA PALLAS UNDER LABORATORY AND FIELD CONDITIONS,
Munich Univ. (Germany, F.R.). Zoologisches Inst.
N. Walz.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2427-2430, 7 Ref, 3 Fig.

Descriptors: *Lake Constance, West Germany, *Mussels, *Food abundance, *Growth rates, *Laboratory tests, Aquatic animals, Foods, Diets, Food habits, Biochemistry, Nutrients, Nutrient requirements, Carbon, Phytoplankton, Filter feeders, Population, Algae, Feeds, Mollusks.

As shown by differences between in-situ (Lake Constance, West Germany) and standard laboratory growth of Dreissena polymorpha, a filter-feeding freshwater mussel, particle concentration alone does not define food quality with respect to growth; further information on intake, assimilation and algal biochemical composition is required. Laboratory experiments were calculated as based on temperature and food concentrations actually present in Lake Constance during 1974. Comparing experimental to field growth rates shows much in common but also uncovers a few meaningful deviations. The first actual phytoplankton maximum (Rhodomonas) in April leads to considerably higher laboratory growth rates than expected under standard conditions. In contrast, Stephanodiscus hantzchii mass development in May (up to 4 mg C/1 from winter 0.1 mg C/1) is not exploited by mussels in lake water tanks. In standard laboratory procedures with alga Nitzschia actinastroides at 4 mg C/1 concentrations, 2% growth rate per day occurs. However, physiological activity, in-situ and under constant standard conditions, is comparable only after laboratory results are recalculated to discover environmental factors which previously never were considered. For example, food biochemical composition is crucial for growth. An insufficiency of a single amino acid can hinder growth. Mussels on mixed phytoplankton diets grow better than those fed with single constitutents alone. Assimilation also is important; standard alga Nitzschia is poorly assimilated (41%) by Dreissena. (Danovich-Wisconsin)
W80-02531

OCCURRENCE AND DYNAMICS OF DREISSENA POLYMORPHA (PALL.) (BIVALVIA),
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
A. Stanczykowska.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2431-2434, 2 Tab, 17 Ref.

Descriptors: *Mollusks, *Lake Milolajski, Poland, *Population, *Organic matter, *Cycling nutrients, *Ecological distribution, Bivalves, Mussels, Distribution, Filtration, Seston, Sedimentation, Ecology, Ecosystems, Mortality, Larval growth stage, Life history studies, Life cycle, Biomass, Productivity, Food webs.

Dreissena polymorpha is one of the most common European bivalve mollusks; however, decisive factors are not available for explaining density and population dynamics. Quantitative D. polymorpha occurrence in lakes is mainly determined by mortality rate in the settling larvae and postveliger state, while individual size and weight are controlled by trophic conditions. Postveliger stage mortality can reach 99% due to unsuitable bottom conditions. Bigger and heavier D. polymorpha occur in high trophic environments. However, D. polymorpha populations changes in density, size and weight affect lake organic matter budgets. During passage through mollusks, seston become saturated with mucus and enriched with bacteria, constituting valuable food for benthic invertebrates. Large biomass, long life cycle (5 years), and extremely long decomposition periods (20 years) mean that D. polymorpha populations store enormous amounts of organic matter and calcium carbonate. Nevertheless, for an ecosystem, filtration ability which can reach 1 1/d, is much more important than biomass production. In Lake Mikolajskie, Poland, with 2,000 ind (D. polymorpha)/sq m, seston consumption amounts to 9% pelagic primary production; feces reach 13% annual sedimentation. At higher densities, mollusk activity is crucial in determining lake organic matter cycling. In many lakes, D. polymorpha accelerates organic matter circulation, modifies the seston and sediment environment, and provides an important link in food webs. (Danovich-Wisconsin)
W80-02532

DISTRIBUTION AND BIOLOGY OF SOME NEARCTIC TUNDRA POOL PHYLLOPODS,
Acadia Univ., Wolfville (Nova Scotia). Dept. of Biology.
G. R. Daborn.
In: Proceedings: Congress in Denmark 1977, Inter-

nationale-Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2442-2451, 5 Fig, 1 Tab, 31 Ref.

Descriptors: *Crustaceans, *Tundra, *Ponds, *Spatial distribution, *Shrimp, Invertebrates, Arctic, Subarctic, Habitats, Distribution, Ecological distribution, Baffin Island, Somerset Island, Biological communities, Food abundance, Foods, Zooplankton, Benthic fauna, Substrates, Ecology, Ecotypes.

Phyllopod investigations of Baffin and Somerset Islands, in the North American Arctic, August-September 1975, reveal that sporadic occurrence of many tundra pool crustaceans does not simply result from chance locations but may be attributed to a precisely suitable foodsupply. Dominant macroscopic zooplankters are usually phyllopods: either Branchinecta paludosa, Artemiopsis stefanssoni, Daphnia middendorffiana, Diaptomus eiseni or Diaptomus minutus. Branchinecta paludosa is holarcticly distributed and is a typical tundra pool inhabitant; it is also recorded in several extralimital records in Alberta, Canada. Another fairy shrimp, Artemiopsis stefanssoni, occurs across arctic Canada and west Greenland with a single extralimital record in Alberta. These extralimital records are probably related to arctic waterfowl migratory patterns. Co-occurrence of two fairy shrimp species is not often recorded at lower latitudes, except where species form a predator-prey association. However, Artemiopsis and Branchinecta are usually spatially separated even in shallow pools. Artemiopsis usually remains near the water surface while Branchinecta swims close to rock or boulder bottom surfaces. Limb morphology and gut contents show that Artemiopsis is a suspension feeder while Branchinecta, deposit feeder. Small pools in bedrock tend to harbor suspension feeders such as Artemiopsis while tundra pools surrounded by sedge meadows and with a detritus bottom layer, exhibit Branchinecta communities. (Danovich-Wisconsin)
W80-02533

DISTRIBUTION AND ECOLOGY OF SVALBARD'S CLADOCERA,
Max-Planck-Inst. fuer Limnologie, Schlitz (Germany, F.R.).
S. Husmann, H. U. Jacobi, M. P. D. Meijering, and B. Reise.
In: Proceedings: Congress in Denmark 1977, Internationale-Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2452-2456. 2 Fig, 14 Ref.

Descriptors: *Svelbard, *Arctic, *Crustaceans, *Daphnia, *Ecological distribution, Distribution, Ecology, Invertebrates, Population, Speciation, Cold regions, Greenland, Habitats, Niches, Biomes, Biological communities, Ecotypes, Pelagic zone, Interstitial water.

During two limnological expeditions to Svalbard (Norwegian Islands in the Arctic Ocean) in 1971 and 1975, Cladocera populations were investigated on Bear Island and Spitsbergen. All Cladoceran sampled in more than 100 sites belong to five species: Daphnia pulex, Daphnia longispina, Macrothrix hirsuticornis, Chydorus sphaericus, and Acroperus harpae. D. pulex shows a high morphologic variability in the Arctic. It occurs in all icefree coastal plains on the main islands. Populations are often fairly large and settle in pelgagic areas of ponds, shallow lakes and beta-oligohaline lagoons. Deeper lakes which usually contain fish, are avoided. D. longispina occurs sporadically in the 43 m deep Ellasjo on Bear Island. M. hirsuticornis is present on all coasts; it occurs up to 122 m above sea level (Bear Island) and settle in interstitial waters and in beta-oligohaline lagoons. C. sphaericus is distributed like D. pulex although it lives in interstitial water on sand and moss along lakes, ponds, and brooks. A. harpae if found in interstitial water in sand and moss along bigger lakes and small rivers. Alona guttata mentioned in 1917 studies, was not found. The limnological and biogeographic situation with respect to cladoceran species distribution limits in Greenland north of 74 N and in Svalbard is nearly identical. Species are closely related to the same latitudes in both regions even though Svalbard, unlike Greenland, is influenced by the Atlantic Gulfstream. (Danovich-Wisconsin)
W80-02534

WHY DO LARGE ZOOPLANKTON SPECIES DOMINATE.,
Academy of Natural Sciences of Philadelphia, PA. Div. of Limnology and Ecology.
C. E. Goulden, L. Hornig, and C. Wilson.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2457-2460. 2 Tab, 12 Ref.

Descriptors: *Fecundity, *Crustaceans, *Dominant organisms, *Size, *Zooplankton, *Population, *Growth rates, Reproduction, Daphnia, Invertebrates, Competition, Predation, Productivity, Growth stages, Mature growth stage, Sexual maturity, Ecology, Ecosystems.

This paper proposes that in the absence of intense size-selective predation by fish, large cladoceran species dominate because of greater reproductive rates, measured by the intrinsic rate of natural increase (r.). This hypothesis is applied only to Cladocera and not to all zooplankton species. Species population growth rate is important in determining competition outcomes. The major reproduction components that determine r are time of first birth and fecundity. Large Daphnia species have large clutch size; many species commonly produce 30-40 young at each birth. Smaller Cladocera, exemplified by bosminids, have maximum size broods of 8-12 young. Within Cladocera, large species carry many small eggs while small species carry few large eggs. R-max was estimated for three species, Daphnia galeata mendotae, Daphnia ambigua and Bosmina longirostris. Even though Bosmina matures earlier (5.18) than either Daphnia species (6.13 and 7.46) higher fecundities of the latter (7.66 and 5.23 for Daphnia and 1.47 for Bosmina) are sufficient to produce a significantly higher r-max (.381 and .385 for Daphnia compared to .315 for Bosmina). Body size (length) positively correlates with r. Further experiments to test the hypothesis are being conducted. (Danovich-Wisconsin)
W80-02535

INFLUENCE OF PREY SIZE, LIGHT INTENSITY, AND ALTERNATIVE PREY ON THE SELECTIVITY OF PLANKTON FEEDING FISH,
Munich Univ. (Germany, F.R.). Zoologisches Inst.
J. Jacobs.
In: Proceedings; Congress in Denmark 1977, Internationale-Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2461-2466. 3 Fig, 21 Ref.

Descriptors: *Predation, *Size, *Light intensity, *Crustaceans, *Ecology, *Laboratory tests, Waterfleas, Niches, Zooplankton, Fish, Light, Distribution, Competition, Mortality, Daphnia, Ecosystems, Selectivity, Light penetration, Euphotic zone, Habitats, Fish food organisms, Food.

Laboratory experiments dealing with prey size, alternative prey, and light intensity reveal at least three cooperative and light-dependent effects which help determine size-dependent selection: (1) detection by mechanical means or chance contact; (2) visual detection, with a threshold at low light intensities and an upper limit of predation rate; and (3) true selection based on central nervous choice after visual comparison. These three effects depend on varying light intensities. At very low light intensities or in darkness, mechanical detection is dominant; differential mortality is proportional to prey size. As light gradually increases, visual detection is reached for larger prey. Simultaneous small prey detection is negligible, resulting in strong relative large prey mortality. As light becomes brighter, both prey types are easily seen and caught, resulting in continued strong selection based on central nervous differentiation. Which effect dominates under natural conditions depends on lake depth and transparency, fish light sensitivity and visual acuity, actual prey size, and vertical zooplankton and fish distribution, and the time of day. These relationships have certain ecological implications: Waterfleas tend to live and feed in the dark; larger and older forms live in lower layer than smaller forms. Smaller prey are also at an advantage in the same spatial niche as larger prey. Whenever mortality by fish outweights productivity(summer), niche overlap would be favored by smaller species. (Danovich-Wisconsin)
W80-02536

ULTRAVIOLET TOLERANCE OF PLANKTONIC CRUSTACEANS,
Munich Univ. (Germany, F.R.). Zoologisches Inst.
O. Siebeck.
In: Proceedings: Congress in Denmark 1977, Internationale-Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2469-2473. 2 Fig, 7 Ref.

Descriptors: *Daphnia, *Crustaceans, *Color, *Ultraviolet radiation, *Resistance, Invertebrates, Light intensity, Plankton, Predation, Pigments, Adaptation, Environmental effects, Speciation, Ecology, Mountains, Mountain lakes, Mortality, Stress, Light, Solar radiation, Photoactivation, Bavaria, West Germany.

Field experiments show that Daphnia pulex obtusa from mountain puddles tolerates higher radiation doses than Daphnia galeata and Daphnia longispina which inhabit lowland lakes; the higher tolerance is due to different ultraviolet intensities. Both cladocerans and copepods exhibit marked coloring in water in mountain regions. By contrast, cladocerans and copepods in clear water lakes are often colorless and transparent. Transparency and color absence serve as protection from various predators, but planktonic crustaceans from mountain pools and puddles exhibit marked coloring. Experiments were performed on D. pulex obtained from shallow mountain puddles and exhibiting a light brown color, and on D. galeata and D. longispina, obtained from deep Bavarian lakes and colorless. Similar-size animals were exposed to direct sunlight in Munich (490 m a.s.l.) in small glass dishes. After six 6 h, all D. galeata and D. longispina had died, while almost all D. pulex were alive. After 8 h, some D. pulex died as well. When dishes were covered with glass plates, mortality was conspicuously lower: all D. pulex survived while losses among D. galeata and D. longispina were also markedly lower, demonstrating that mortality is predominately due to ultraviolet radiation. Mean lethal dose for D. pulex amounts to 0.77 Ws/sq cm and 0.49 Ws/sq cm for D. galeata. (Danovich-Wisconsin)
W80-02537

INCORPORATION RATES OF SIMOCEPHALUS VETULUS SCHOEDLER AS INFLUENCED BY FOOD SIZE,
Windsor Univ., (Ontqrio). Dept. of Biology.
L. Bevan, J. M. Winner, and D. G. Wallen.
In: Proceedings: Congress in Denmark 1977, Internationale-Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2474-2478, 3 Fig, 1 Tab, 22 Ref.

Descriptors: *Foods, *Size, *Feeding rates, *Algae, *Crustaceans, Food abundance, Productivity, Tracers, Food habits, Animal behavior, Nutrients, Zooplankton, Cultures, Ecology, Carbon, Laboratory tests, Selectivity.

Studies investigating carbon incorporation rates of a littoral cladoceran, Simocephalus vetulas show that this crustacean selectivity grazes on the larger Euglena gracilis with Chlamydomonas reinhardti as second choice. In unialgal cultures, S. vetulus incorporation rates are asymptotic, increasing linearly to a maximum rate with increasing ration concentration. The incipient limiting concentration for assimilation rates varies with different algal species. These values are inversely proportional to algal ration diameter, being 12,000 cells/ml for Chlorella vulgaris, 10,000 cells/ml for Chlamydomonas, and 5,000 cells/ml for Euglena. Maximal assimilation rates are 0.0728 micro g C/ind h for Chlorella, 0.0859 micro g C/ind h for Chlamydomonas, and 0.1074 micro g C/ind h for Euglena. S. vetulus, fed on mixed algal rations, with one spe-

cies labelled with radioactive carbon, incorporates carbon (C) at rates proportional to algal size. When Euglena is the labelled species, incorporation rates are 0.1317 micro g C/ind h. Rates for Chlamydomonas (0.0698 micro g C/ind h) and Chlorella (0.0104 micro g C/ind h) are lower. Diameters of the three species are 2.8 micro m (Chlorella), 5.5 micro m (Chlamydomonas) and 13.7 micro m (Euglena). Even though S. vetulus C incorporation rates are higher when feeding on Euglena in unialgal cultures, efficiency measurements comparing C incorporation rates to total C amounts available show that Chlorella is used 20 times more efficiently than Euglena and three times more efficiently than Chlamydomonas. (Danovich-Wisconsin)
W80-02538

POPULATION REGULATION OF THE CHYDORIDAE IN LAKE ITASCA, MINNESOTA,
Tennessee Univ., Knoxville. Dept. of Zoology.
J. B. Williams, and M. C. Whiteside.
In: Proceedings: Congress in Denmark 1977, Internationale-Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2484-2489, 2 Fig, 15 Ref. NSF BMS 72-00079.

Descriptors: *Population, *Lake Itasca(MN), *Crustaceans, *Food webs, *Ecology, Zooplankton, Invertebrates, Growth rates, Reproduction, Mortality, Littoral, Predation, Distribution, Laboratory tests, On-site investigations, Fish food organisms, Productivity, Balance of nature, Distribution patterns.

Field and laboratory experiments on chydorid populations in Lake Itasca, Minnesota April 1975-August 1976, show that the characteristic summer population crash is due not to decreases in chydorid birth rates but to increases in chydorid deaths due to predation. Lake Itasca is located in north central Minnesota with a 436 ha surface area; 55% of the lake is littoral. The five most abundant Chydoridae are Chydrous sphaericus, Alonella excisa, Pleuroxus denticulatus, Acroperus harpae, and Alonella nana, whose combined numbers represent 80% of total Chydroidae. The population is always over-dispersed. Chydorus populations peak in late spring or early summer. C. sphaericus and P. denticulatus also have midwinter peaks. Population numbers of all five species crash to very low numbers immediately following their summer peaks. In order to determine population control mechanisms, birth rates were estimated by Edmondson egg ratio techniques. Chydorus, Pleuroxus, Acroperus, and A. nana populations were observed. Those protected populations from predation in Biomonitors showed continuous growth, while unprotected populations crashed to low levels. Chydorids are part of a complex food web involving littoral and limnetic species. Chydorids are found in the digestive system of many fish and also Chaoborus, Chironomus, and Odonata nymphs. (Danovich-Wisconsin)
W80-02539

MORPHOLOGICAL AND BEHAVIORAL INTERACTIONS BETWEEN A CARNIVOROUS AQUATIC PLANT (UTRICULARIA VULGARIS L.) AND A CHYDOID CLADOCERAN (CHYDORUS SPHAERICUS O.F.M.),
Wisconsin Univ., Madison. Dept. of Zoology.
D. G. Meyers, and J. R. Strickler.
In: Proceedings: Congress in Denmark 1977, Internationale-Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2490-2495, 1 Fig, 2 Tab, 18 Ref. NSF DEB 76-02096.

Descriptors: *Ecology, *Littoral, *Crustaceans, *Aquatic plants, *Symbiosis, *Mode of action, *Diurnal, Invertebrates, Zooplankton, Foods, Predation, Substrates, Movement, Animal behavior, Plant physiology, Plant morphology, Food habits, Distribution, Microenvironment, Grazing, Filter feeders.

This paper describes associations between Chydorus sphaericus O.F.M., a chydorid cladoceran and Utricularia vulgaris L., a carnivorous, aquatic plant that serves as both a substrate and predator to chydorids. Experiments on chydorid activity patterns reveal distinct diurnal activity differences; chydorids move both farther and faster during the day, greater numbers are captured by Utricularia at night. Utricularia predominantly captures slower moving grazing animals; and at night 60% of the active chydorids move less than 1 sec compared with 30% during daytime. Chydorid motion at night is active grazing, with more animals attached to Utricularia as a substrate and, consequently, a higher probability of animals contacting utricularia bladder doors which lead to capture. During the day, chydorid populations have less actively grazing individuals. Swimming speeds are faster and animals move more directly from one resting spot to another. When perched on Utricularia antennae or bristles, chydorids are not passive but are actively filter-feeding. These studies on chydorid microdistribution and vertical migration strongly contradict previous hypotheses of littoral ecology. (Danovich-Wisconsin)
W80-02540

A PREDATION MODEL OF ZOOPLANKTON COMMUNITY STRUCTURE,
Washington Univ., Seattle. Dept. of Zoology.
T. M. Zaret.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2496-2500, 2 Fig, 2 Tab, 16 Ref. NSF BMS 74-122282.

Descriptors: *Predation, *Model studies, *Fish, *Zooplankton, *Biological communities, *Lakes, *Swedish, Mathematical models, Crustaceans, Invertebrates, Size, Ecology, Ecotypes, Animal behavior, Curves, Competition, Nutrients, Food habits, Foods, Fish behavior, Fish food organisms.

A predation model based on predictions of limnetic zooplankton assemblages from knowledge of predators present in any lake system, confirms that predation and competition are of ultimate importance in structuring elements of freshwater systems. The model tested with data from northern Swedish lakes, is based on interactive relations between two dominant classes of freshwater predators. Class I, gape-limited predators, is best characterized by an electivity curve which increases with prey attractibility. The most important Class I predators are fish. Class II or size-dependent predators, select prey according to body-size. This electivity curve is bell-shaped; predators include crustaceans such as cladocerans, copepods, and also rotifers. Using an interactive approach, the model predicts: (1) In the absence of Class I predators, Class II predators are dominant and zooplankton prey assemblages are dominated by large herbivorous species. (2) As Class I predation increases, large herbivores, are replaced by medium-size ones. (3) With still-increasing Class I predators, medium-size herbivores are replaced by smaller ones. (4) As Class I predation becomes more intense, dominant herbivores are replaced by still smaller ones and Class I consumption of Class II predators results in a gradual transition to smaller-sized invertebrates predators. (Danovich-Wisconsin)
W80-02541

STRATEGIES FOR CO-EXISTENCE IN TWO LIMNETIC CYCLOPOID COPEPODS,
Freshwater Biological Association, Ambleside (England).
W. J. P. Smyly.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2501-2504, 3 Fig, 1 Tab, 2 Ref.

Descriptors: *Ecology, *Copepods, *Competition, *English Lake District, United Kingdom, Crustaceans, Invertebrates, Water temperature, Distribution, Population, Speciation, Depth, Thermocline, Limnetic zone, Habitats.

Studies of two limnetic cyclopoid copepod species, Cyclops abyssorum and Mesocyclops leuckarti in the English Lake District show temporary increases in annual abundance of the scarcer species; however, in the long-term, one species will predominate and exclude the other. In Britain, C. abyssorum is rare in the south; M. leuckarti is rare in the north. The English Lake District, located in the northwest, is an area where species overlap. C. abyssorum is widely distributed, whereas M. leuckarti is limited to the Windermere drainage area and a northern valley. C. abyssorum instars are larger than corresponding M. leuckarti instars. Mean annual abundance values in Esthwaite Water (1956-1971) show M. leuckarti as the more numerous species (60,000-100,000 ind/sq m). C. abyssorum is comparatively scarce (10,000-20,000 ind/sq m) except for the period from 1963-1968 (20,000-50,000 ind/sq m), following an exceptionally cold period. In Rydal Water where C. abyssorum is dominant, M. leuckarti is found only briefly. These results show that even in warmer, shallow lakes, C. abyssorum can regain abundance, if only temporarily, in a lake dominated by M. leuckarti, and at least in one lake, be the dominant species. When Windermere is isothermal, both species are evenly distributed vertically; during thermal stratification, C. abyssorum inhabits deeper waters. In cold months, although vertical overlap is extensive, population densities are low, and competition interactions probably minimal. (Danovich-Wisconsin)
W80-02542

PREY SELECTION BY THE CYCLOPOID COPEPODS MESOCYCLOPS EDAX AND CYCLOPS VICINUS,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
Z. Brandl, and C. H. Fernando.
In: Proceedings: Congress in Denmark 1977, Internationale Veneinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2505-2510, 5 Fig, 1 Tab, 12 Ref.

Descriptors: *Predation, *Size, *Copepods, *Food webs, *Ecosystem, *Animal behavior, Ecology, Foods, Food abundance, Zooplankton, Food habits, Diets, Density, Speciation, Crustaceans, Rotifers, Growth stages, Larvae, Feeding rates, Daphnia.

Both Cyclops vicinus and Mesocyclops edax predatory feeding is selective depending on prey species; within species, feeding relates to on specimen size. However, size is not always decisive for preference of some rotifer species. Large Applanchna is more commonly selected than small Keratella cochlearis. Predation is also dependent on prey species density. C. vicinus and M. edax prey include practically all species of rotifers, copepods, and cladocerans coexisting with predators. Both predators are generally similar in their feeding. C. vicinus and M. edax clearly prefer certain prey species. Diets mainly consist of rotifers, copepods larvae, and some cladocerans. Various rotifers, especially Polyarthra, and calanoid copepod larvae constitute a much higher proportion of captured prey than their corresponding percentage in zooplankton. Other species such as cyclopoid copepod naupliar larvae, larvae of the predator itself and rotifer Keratella cochlearis, are important diet components, however, their importance in the diet closely corresponds to that in zooplankton assemblages. Predation is also selective upon smaller speciemens of a given prey species. Predation rate is three times higher on smaller Brachionus angularis from two summer rates. (Danovich-Wisconsin)
W80-02543

EQUIVALENCE OF COPEPOD AND INSECT DIAPAUSE,
Olso Univ. (Norway). Inst. of Zoology.
K. Elgmork, and J. P. Nilssen.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2511-2517, 3 Fig, 1 Tab, 21 Ref.

Descriptors: *Copepods, *Dormancy, *Norway, *Lakes, *Bottom sediments, *Diapause, *Growth stages, Invertebrates, Crustaceans, Zooplankton, Lake sediments, Animal physiology, Photoperiodism, Depth, Animal behavior, Metabolism, Life

cycles, Physiological ecology, Population, Ecology, Aquatic insects.

Bottom lake sediments from many Norwegian localities were investigated for cyclopoid emergence rates; diapause phase sequence corresponds in detail to that for insect diapause. These findings support the theory that dormancy phenomena in insects and cyclopoid copepods are governed essentially by the same physiological processes. Active penetration or the presence of resting stages relatively deep in bottom sediments indicates diapause in copepods. Older instars occur somewhat deeper in sediments. Most dormant copepodids are situated in the uppermost 2.5 cm mud layers. Fractions of the populations are, however, found as deep as 10 cm. Diapause includes preparatory, induction, refractory, activated, and termination phases. Preparation for dormancy is clearly present in freshwater cyclopoids; instars accumulate in water layers above bottom sediments. During induction, a rapid and marked increase in dormancy occurs. During refractory phases, intensity and duration varies. Deepest torpor was observed in Cyclops stenuus (20 cm) in a shallow pond during an exceptionally hot summer. Activation is indicated by gradually rising curves; torpidity is now diminished. Termination is characterized by practically all resting phase stages leaving the sediments; this phase is very short and usually occurs in spring. Growth, development, and reproduction are immediately resumed. (Danovich-Wisconsin)
W80-02544

LIFE CYCLE STRATEGIES IN NEIGHBOURING POPULATIONS OF THE COPEPOD CYCLOPS SCUTIFER SARS,
Olso Univ. (Norway). Inst. of Zoology.
K. Elgmork, J. P. Nilssen, T. Broch, and R. Ovrevik.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2518-2523, 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Life cycles, *Copepods, *Norway, *Lakes, *Predation, *Abiotic environment, Crustaecans, Zooplankton, Diapause, Ecology, Population, Growth stages, Dormancy, Photoperiodism, Animal physiology, Physiological ecology, Metabolism, Life history studies, Environmental effects, Fish, Seasonal.

Variation in life cycle patterns of Cyclops scutifer in five Norwegian lakes is difficult to explain by abiotic factors; while fish predation better explains observed cycles, discrepancies also exist with this hypothesis. Five C. scutifer populations were compared in five southern Norway lakes less than 3 km apart and in the same watershed. Three lakes exhibit one-year cycles; two have a partial two-year cycle. Dormancy is present in only one population. Reproduction takes place in early summer in three lakes and occurs throughout summer in two lakes. Nauplii produced during summer can either postpone or directly proceed with development. Great variations in C. scutifer seasonal cycles occur in a restricted area with the same climate and photoperiodicity. Possible regulatory factors are therefore most likely restricted to the lake or parts of the lake. One particular problem is the diapausing population; this particular lake shows no special environmental factors, being medium in size, depth, oxygen and humic contents. Generally, abiotic factors seem unrelated to life cycle patterns. By comparing life cycles and fish predation, both populations with a partial two-year cycle occur in communities with high fish predation. However, other lake populations do not fit this hypothesis; factors other than predation are obviously in operation. (Danovich-Wisconsin)
W80-02545

COPEPODA AND CLADOCERA COMMUNITIES IN A RIVER-SWAMP SYSTEM,
Indiana Univ. at Bloomington. Dept. of Biology.
M. W. Binford.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2524-2530. 1 Fig, 4 Tab, 11 Ref 14-16-008-767.

Descriptors: *Biological communities, *Zooplankton, *Habitats, *Rivers, *Swamps, *Atchafalaya River(LA), Crustaceans, Copepods, Invertebrates, Tributaries, Lotic environment, Lentic environment, Distribution, Distribution patterns, Ecological distribution, Statistics, Statistical methods, Correlation analysis, Dissolved oxygen, Speciation, Ecosystems.

Copepods and cladoceran plankton assemblage composition among different habitats along the Atchafalaya River, Louisiana, was investigated September 1973-1974. Atchafalaya, a distributary of the Mississippi River, is a complex of rapidly changing environments. Its basin is 173 km long with average 29 km width, covering 5180 sq km in south central Louisiana. Thirty-four taxa account for more than 95% of all specimens. Hotelling-Lawley's Trace statistical test reveals three significant habitat differences: (1) lotic vs lentic; (2) main river vs distributary channels; and (3) upper swamp vs lower swamp. Only one species, Diaptomus pallidus, is a distributary form. Eleven species including Ceriodaphnia quadrangula and Eurytemora affinis are found in both rivers and distributaries. Diaphanosoma leuchtenbergianum, Daphnia parvula, and three other species occur primarily in rivers. five taxa including Diaphanosoma brachyurum and Ilyocryptus spinifer, are swamp forms. Four species could not be assigned to habitats because no pattern was evident. Seven species are ubiquitous. Bosmina longirostris is the most widespread and abundant organism. Assemblages are based on habitat preference and not actual cooccurrence. Two factors may govern habitat preference; Twelve of the 16 river, distributary, and river-distributary species statistically correlate with dissolved oxygen. Secondly, swamp taxa are generally more littoral, while river and distributary forms and more pelagic. (Danovich-Wisconsin)
W80-02546

INSTAR-SPECIFIC SWIMMING PATTERNS AND PREDATION OF PLANKTONIC COPEPODS,
Georgia Univ., Athens. Dept. of Zoology.
J. Gerritsen.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2531-2536. 4 Fig, 1 Tab, 17 Ref. NSF DEB 76-02096.

Descriptors: *Copepods, *Predation, *Midges, *Swimming, *Animal behavior, *Period of growth, Zooplankton, Crustaceans, Larvae, Ecology, Growth stages, Physiological ecology, Mode of action, Food habits, Immature growth stage, Juvenile growth stage, Larval growth stage, Mature growth stage, Animal physiology, Life history studies, Size, Mortality, Diurnal.

Laboratory experiments using larvae Chaoborus as predators and Cyclops scutifer as prey demonstrate that planktonic animals, through behavioral and morphological ontological development, are susceptible to different kinds of predators at different stages in their lives. Animals were collected from Fuller Pond, Connecticut and from Lake Heney, Quebec, Canada. Cyclops show considerable changes in swimming behavior during ontogeny. Nauplii remain virtually motionless and only occasionally make short hops. When disturbed they make rapid sinking movements of 1 cm or more. First stage copepodites (CI) exhibit hop-and-sink swimming patterns but have slow sinking speeds and make nauplii-like escape leaps. Copepodites CII, CIII, CIV and adult males all show similar, moderate swimming speed (0.5.2mm/s), while CV and adult females have faster swimming speeds (2-4mm/s). These stages all show characteristic hop-and-sink patterns and flap the abdomen during rapid escape. C Scutifer are more active during the day than at night. Adult Cyclops have lower probabilities of being captured by Chaoborus than do juveniles; however, adults and juveniles suffer higher predation rates than nauplii. Nauplii, which move hardly at all, cause few disturbances in the water to advertise their presence, and thus have three advantages: (1) low encounter rates with predators; (2) effective decrease of vibration-sensitive predator's encounter radii by cryptic movements, and (3) low energy use by not employing hop-and-sink behavior. (Danovich-Wisconsin)
W80-02547

ASPECTS OF THE ZOOGEOGRAPHY OF AUSTRALIAN MICROCRUSTACEANS,
Monash Univ., Clayton (Australia). Dept. of Zoology.
I. A. E. Bayly, and D. W. Morton.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2537-2540, 2 Tab, 18 Ref.

Descriptors: *Crustaceans, *Distribution, *Systematics, *Speciation, *Geographical regions, *Australia, *Ecological distribution, Distribution, Patterns, Microorganisms, Zooplankton, Copepods, Microenvironment, Invertebrates, Varieties, Geology, Geologica control, Geological history, Ecology, Ecosystems.

This review increases the number of known cyclopoid species in Australia from 18 to 44 and involves 17 new species. Australian fauna consists predominantly (60%) of endemic species. A new genus, which is similar to Acanthocyclops, contains three species, Genus Microcyclops furnishes over 40% of total endemics and one-third total Australian cyclopoid copoepod fauna. Mixocyclops, Paracyclops and Halicyclops are further genera containing mainly endemic species. Other genera include Mesocyclops, Macrocyclops, Tropocyclops, Eucyclops, and Ectocyclops. Some taxa which contain cosmopolitan species may also contain other species which are highly restricted; species distribution within such taxa may be of considerable biogeographical significance. The genus Boeckella is restricted to the southern hemisphere (Australia, New Zealand, and South America), with one exception: B. orientalis occurs in Mongolia and Manchuria. Crawford's revised view concerning the present distribution of former Gondwanaland portions, makes this otherwise mysterious biogeographical distribution more comprehensible. B. triarticulata is the commonest and most widely distributed boeckellid in Australia. Distribution of Daphniopsis, which occurs in Tibet, Mongolia, Australia, and Antarctica, is also explained by Crawford's reconstruction. (Danovich-Wisconsin)
W80-02548

CAROTENOID PHOTOPROTECTION IN DIAPTOMUS KENAI,
Rhode Island Univ., Kingston. Dept. of Zoology.
N. G. Hairston, Jr.
In: Proceedings: Congress in Denmark, 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2541-2545. 1 Fig, 1 Tab, 16 Ref. ERDA AT(45-1)-2225-T23.

Descriptors: *Pigments, *Color, *Copepods, *Findly Lake(WA), *Upper Findley Pond(WA), Light, Light intensity, Light penetration, Biochemistry, Photoactivation, Mortality, Predation, Depth, Animal physiology, Metabolism, Crustaceans, Zooplankton, Proteins, Animal behavior.

Experiments on copepods from clear mountain lakes in Washington conclude that carotenoid pigments provide photoprotection; copepods containing large pigment amounts survive near the lake surface where food is abundant and sunlight most intense, while those containing little pigment must reside at greater depths. Diaptomus kenai bright-red copepods were collected from Findley Lake (9.0 ha) while bluesky individuals were obtained from Upper Findley Pond (0.68 ha) in August, 1976. Both water bodies are located in a deep, steep-walled basin at 1,130 m, Washington. Red D. kenai contain over three times (7.49 micro g/mg dwt) as much pigment as blue D. kenai (2.30 micro g/mg dwt). When exposed to light from blue fluorescent lamps, average time to death for red copepods is 5.68 d compared to 2.47 d for blue copepods. The significance of blue carotenoprotein is nuclear. A blue copepod is less visible to pred-

ators since its color matches the environment more closely than red copepods. A selective compromise between predation pressures and photodamage might be reached by binding carotenoid to proteins and turning it blue. Carotenoid contents for D. sicilis and D. nevadensis adults from two other mountainous Washington lakes was determined for animals collected at different depths. In five out of seven cases, copepods near the lake surface are significantly more pigmented than those collected at greater depths. (Danovich-Wisconsin)
W80-02549

POPULATION DYNAMICS OF EUDIAPTOMUS GRACILIS (SARS) IN LAKE OHRID,
Hidrobioloski Zavod, Ochrida (Yugoslavia).
J. Serafimova-Hadzisce.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2546-2550. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Population, *Copepods, *Lake Ohrid, Yugoslavia, *Life history studies, *Life cycles, Zooplankton, Crustaceans, Biomass, Period of growth, Growth rates, Growth stages, Sexual maturity, Reproduction, Seasonal, Animal behavior, Ecology, Density, Stability.

A comprehensive zooplankton investigation for Lake Ohrid, Yugoslavia, was carried out April 1973-June 1975; yearly demographic structure for Eudiaptomus gracilis was repeated annually showing that not only plankton communities in general but also separate species have great stability in large, deep lakes. E. Gracilis is the most important zooplankton component in Lake Ohrid. In April, E. gracilis has a maximum number of naupliar and copepodite stages as well as large adult numbers. It reaches 4,000 ind/cu m. Intensive reproduction also occurs during this period. In June, copepods dominate but E. gracilis decreases in density to 1100-1800 ind/cu m. During July and August, E. gracilis populations continue to decline. In September, density varies 1300-2400 ind/cu m and copepodites are particularly abundant while other stages have low numbers. November to January, population density decreases. In February, E. gracilis begins to reproduce; March is characterized by intense reproduction. About 90% of females carry eggs and males adult numbers increase. Although E. gracilis occurs throughout the year, it is the dominant copepod species during winter and spring. Laboratory experimental research concludes that E. gracilis turnover time is three times per year. (Danovich-Wisconsin)
W80-02550

CARBON ANALYSIS FOR THE DETERMINATION OF INDIVIDUAL BIOMASSES OF PLANKTONIC ANIMALS,
Helsinki Univ., Lammi (Finland). Lammi Biological Station.
R. Latja, and K. Salonen.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2556-2560. 4 Tab, 12 Ref.

Descriptors: *Carbon, *Zooplankton, *Weight, *Analytical techniques, *Testing procedures, Size, Speciation, Seasonal, Volumetric analysis, Testing, Lake Paajarvi, Finland, Lake Ormajarvi, Finland, Evaluation, Specific gravity, Organic matter, Lakes, Oligotrophy, Eutrophication.

Organic carbon analysis as a possible solution to the problem of systematic errors allows determinations in single animals down to 0.01 micro g C in one minute. Zooplankton were collected from mesohumic oligotrophic Lake Paajarvi and eutrophic Lake Ormajarvi, Finland. Each animal is transferred to a high temperature combustion tube (950 C) and carbon dioxide release is measured by infrared gas analysis. Standard deviation for one sample varies 20-60% of the mean. Analysis precision is better than 1% at 1 micro g C level. Measured carbon weights are higher than those calculated from volumes assuming a specific gravity of 1, dry weight 10% of wet weight, and carbon 50% of dry weight. However, Asplanchna priodonta shows calculated values much higher (4-100 times) than measured ones. Rotifer carbon levels are 5-10% wet weight. However, for Asplanchna, the respective level is only 0.8%. Individual carbon weights for Asplanchna reveal considerable seasonal variation. In summer, mean weight is five times higher than in early spring and values for the same season in successive years are similar. Limnoclanus macrurus carbon content is 3.2-3.5 times more in autumn than in spring. Eudiaptomus gracilis carbon weights for similar-sized animals are higher in late winter in Ormajarvi than in more oligotrophic Paajarvi. Dry weight is reliable for individual biomass measurements, but differences between lakes and seasons complicate using general values for a given species' individual weight. (Danovich-Wisconsin)
W80-02551

POPULATION STRUCTURE AND LIFE-CYCLE OF NEOMYSIS INTEGER (LEACH) (CRUSTACEA, MYSIDACEA) IN TWO TYPES OF INLAND WATERS,
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
C. H. Borghouts.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2561-2565. 4 Fig, 4 Ref.

Descriptors: *Lake Veere, The Netherlands, *Den Inkel, The Netherlands, *Population, *Opossum shrimp, *Life history studies, *Life cycles, Ecology, Zooplankton, Crustaceans, Chlorine, Size, Fecundity, Seasonal, Density, Biomass, Water quality, Growth stages, Growth rates, Sexual maturity, Brackish water.

During January 1970-June 1972, population structure and life-cycle of Neomysis integer were studied in two inland waters: large (1800 ha) brackish water Lake Veere and small (4.4 ha) Den Inkel, Netherlands. In Lake Veere, chlorinity fluctuates 5.5-12.5 ppt during the year. In Den Inkel, chlorinity is rather constant, 7.5-9 ppt. Population differences in Lake Veere and Den Inkel mainly concern animal length and proportion of juveniles. Maximum N. integer length in Lake Veere is 19 mm and in Den Inkel, 13 mm. Difference in length between the populations is due to slower growth in Den Inkel, probably because of higher population densities. Breeding females of Lake Veere are larger than those in Den Inkel; brood-size in Lake Veere therefore is larger than in Den Inkel. In both waters, breeding females are larger in spring than in autumn. In spring, Lake Veere lengths are 15-19 mm, in Den Inkel, 10-13 mm. In autumn, breeding females lengths are 10-15 mm and 7-9 mm, respectively. Life-cycle of both populations does not differ. The overwintering generation breeds in April-May and produces the spring generation. This spring generation grows, matures, and starts breeding in June-July. This continues until September in Lake Veere and until August in Den Inkel. Animals born in autumn grow up and overwinter. (Danovich-Wisconsin)
W80-02552

POPULATION DYNAMICS AND BIOMASS PRODUCTION OF NEOMYSIS INTEGER (LEACH) IN THE BERGUMERMEER,
Limnological Inst., Oosterzee (Netherlands).
D. M. Beattie, and H. DeKruijf.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2566-2571. 7 Fig, 6 Ref.

Descriptors: *Bergumermeer, The Netherlands, *Biomass, *Population, *Opossum shrimp, *Life history studies, *Electric powerplants, Standing crops, Ecology, Zooplankton, Crustaceans, Life cycles, Juvenile growth stage, Growth stages, Growth rates, Heated water, Thermal stress, Bottom sediments, Density, Seasonal, Discharge(Water), Thermal pollution, Thermal water.

From June 1976-June 1977, Neomysis integer population dynamics were observed in Bergumermeer a shallow eutrophic powerplant, situated in The Netherlands; thermal discharges have negligible effects on N. integer population development. The lake has 4.65 sq km surface area and 1.3 mean depth; western sections have mud or peat, soft substrate bottoms while the eastern part has harder sand substrates. Population growth rates are similar on hard and soft substrates, but population size on hard substrates is three times larger than on soft substrate. Virutally 100% of the population is on the bottom during the day, while it spreads throughout the water column at night. Population development occurs May to September (1/sq m to 4,500/sq m), constituting a continuous breeding season with maximum population density peaks following periods of more intensive breeding. Changes in N. integer standing crop biomass closely parallel changes in population density. An exponential increase in dry weight standing crop biomass occurs July to September (0.1 to 62.0 kg/ha), accompanying juvenile influx into the population. Mean dry weight per individual is 0.91 mg. Standing crop biomass continues to increase until October (154.0 kg/ha) due to increases in mean dry weight per individual to 1.65 mg, although population density is constant. Slower and more erratic population growth occurs near the powerplant outlet due to variable cooling water discharges and increased fish predation. (Danovich-Wisconsin)
W80-02553

INTRASPECIFIC OSMOREGULATORY COMPARISON IN GAMMARUS PULEX (CRUSTACEA: AMPHIPODA),
Amsterdam Univ. (Netherlands). Limnological Lab.
J. Dorgelo.
In: Proceedings: Congress in Denmark, 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2573-2578. 2 Fig, 1 Tab, 28 Ref.

Descriptors: *Salt tolerance, *Metabolism, *Amphipoda, *Osmosis, *Habitats, Salinity, Saline water, Brackish water, Salts, West Germany, The Netherlands, Resistance, Animal behavior, Environment, Crustaceans, Population, Freshwater, Ecology, Mortality, Desalination processes, Animal physiology.

This study analyzes salt tolerance, salt preference, and blood sodium regulation of Gammarus pulex populations from The Netherlands and West Germany in environments with increasing sodium, chloride and calcium concentrations. Tolerance curves, and to a lesser extent, preferential behavior show differences according to increasing habitat salinity. However, different blood sodium concentrations do not correlate with salinity habitat trends. G. pulex populations survive well at all sampling stations. The population from the most brackish environment has the greatest salt tolerance. Curves for two freshwater populations resemble the curve for G. fossarum, which marks these populations as genuine fresh-water populations. Populations which live under less-saline conditions tend to have a decreasd salt tolerance. Regarding salt preference, the genuine fresh-water species is characterized by a lack of preference; distribution in choice chambers is unstable. Some other populations prefer their habitat water while still others behave indifferently to concentrations within 1 ppt of their habitat water concentration. Regulation sensing matintenace of a more or less constant blood sodium content occurs in low salinities only. G. pulex shows hyperregulation levels that drop with decreasing habitat salinity. Populations from the most limnetic conditions have the highest blood sodium concentration. (Danovich-Wisconsin)
W80-02554

AMPHIPODA FROM SKADAR LAKE AND ITS DRAINAGE SYSTEM,
Biological Inst., Titograd (Yugoslavia).
G. S. Karamna.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2579-2583. 1 Fig, 15 Ref.

Descriptors: *Amphipoda, *Habitats, *Distribution, *Skadar Lake, Yugoslavia, *Drainage area, Crustaceans, Invertebrates, Environment, Ecology, Distribution patterns, Ecological distribution, Speciation, Population, Systematics, Water temperature, Watersheds(Basins), Varieties, Caves, Wells, Rivers, Spring waters.

Amphipoda in the drainage system of Skadar Lake, Yugoslavia consists of one family' (Gammaridae), of seven general with a total of 16 species, namely: Echinogammarus scutarensis, E. veneris, Gammarus balcanicus, G. roeselii f. tricanthus, Hadzia gjorgjevici crispata, Niphargus asper, N. brevicuspis sketi, N. inclinatus, N. maximus vulgaris, N. podgoricensis, N. vranjinae, N. zorae, Metohia carinata, Synurell ambulans, S. intermedia montenigrina, and Typhlogammarus mrzeki. Echinogammarus and Gammarus species inhabit surface waters, 11 species (general Niphargus, Typhlogammarus, Metohia, Hadzia, and species S. intermedia montenigrina) settle only in subterranean waters while S. ambulans lives in surface and subterranean waters. In the lake itself, amphipoda are poorly represented and exist only in coastal areas influenced by springs and rivers (E. veneris, E. scutarensis, G. balanicus, G. roeselii, S. ambulans). This is caused by warm lake temperatures which reach 29 C. Subterranean fauna are abundant with five genera and 12 species. Nine subterranean species are endemic and a single surficial species, E. scutarensis, is endemic. Two species, T. mrazeki and M. carinata, are endemic for west Balkan. Species G. balcanicus, G. roeselii, E. veneris, and S. ambulans are widely distributed. Skadar is a large subtropical lake situated in southeast Yugoslavia with a 4000 sq km drainage system. Median water level varies around 370 sq km; mean depth is 6 m but lake levels vary up to 4 m. (Danovich-Wisconsin)
W80-02555

LIFE HISTORIES OF FOUR SPECIES OF EPHEMEROPTERA,
T. T. Macan.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2594-2598. 1 Fig, 9 Ref.

Descriptors: *Life history studies, *Life cycles, *Lune River, Great Britain, *Mayflies, Reproduction, Growth rates, Growth stages, Water temperature, Ecology, Animal behavior, Diapause, Aquatic insects, Invertebrates, Emergence, Size, Length, Nymphs, Seasonal, Distribution, Population.

Four Ephemeroptera species, Centroptilum pennulatum, Procloeon bifidum, Centroptilum luteolum, and Baetis scambus, were observed in the Lune River, Great Britain, April to October 1973-1975. Most C. pennulatum nymphs emerge at 7 mm. The generation originates from diapause eggs, starts suddenly about May 21, and numbers increase (47-124) in the first five weeks. A few nymphs are large enough to emerge by June 4. By this third week, sizes range 2-8 mm. This spread indicates that eggs of the next generation hatch over a long time period; identification of generations is less likely with each succeeding one. Eggs hatch in one week and a generation takes about five weeks. Quick growers may achieve five generations during a season while slow growers achieve only three. Other life cycles hypothesis suggest that all cohorts develop from eggs laid the year before; some hatch soon and the rest enter diapause depending upon water temperatures. P. bifidum nymphs are ripe when they reach 5-7 mm. Generations are similar to C. pennulatum. C. luteolum nymphs emerge when 6 mm and sometimes 5 mm. A few nymphs, most 2 mm, are found throughout winter. During summer, there are probably four or five generations. B. scambus nymphs emerge when 5 mm, although some are only 4 mm. Their numbers are larger than any other species and tend to be separated by very low numbers. Low catches suggest a long period in the egg. Generations take a month and the season lasts longer for B. scambus than any other species. (Danovich-Wisconsin)
W80-02556

PRODUCTION OF TWO SPECIES OF EPHEMEROPTERA (EPHEMERELLA IGNITA PODA AND RHITHROGENA SEMICOLORATA CURTIS) IN THE UPPER REACHES OF THE R. WYE, WALES,
Llysdinam Field Centre (Wales).
M. P. Brooker, and D. L. Morris.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2600-2604. 2 Fig, 3 Tab, 8 Ref.

Descriptors: *Mayflies, *River Wye, Wales, *Habitats, *Primary productivity, Aquatic insects, Invertebrates, Productivity, Density, Distribution, Ecology, Population, Growth rates, Turnovers, Biomass, Analytical techniques, Estimating, Depth, Emergence, Life cycles.

Two sites in headwaters of the Wye River, Wales, were intensively studied March 1975-April 1976 for production estimates of two Ephemeroptera species; annual production of Ephemerella ignita and Rhithrogena semicolorata is 89 and 353 mg dwt/sq m. Both study sites are typical salmon nursery areas with cobbles and coarse gravel forming a riffle habitat. E. ignita and R. semicolorata form a substantial proportion of total invertebrate and ephemeropteran density. R. semicolorata reached 470/sq m mean peak density (November) and E. ignita reached 440/sq m in June. Over 90% of each species occurs within 10 cm of the water surface, the rest within 20 cm. Differences in production occur between sites for both species; however, calculation method differences are significant. One method excludes negative production (A) and the other includes average instantaneous growth rates (B). For E. ignita at the most distant headwater site, method A estimates production at 344 mg dwt/sq m; method B, 794 mg dwt/sq m. Production for R. semicolorata is 216 (A) and 249 (B) mg dwt/sq m. At the other site, E. ignita production values are 89 (A) and 164 (B) mg dwt/sq m, while for R. semicolorata values are 353 (A) and 435 (B) mg dwt/sq m. (Danovich-Wisconsin)
W80-02557

PRELIMINARY NOTES ON THE EFFECT OF TEMPERATURE AND LIGHT-CONDITION ON THE TIME OF HATCHING IN SOME HEPTAGENIIDAE (EPHEMEROPTERA),
Oesterreichische Akademie der Wissenschaften, Vienna. Limnologisches Inst.
U. Humpesch.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2605-2611, 3 Fig, 14 Ref.

Descriptors: *Water temperature, *Amphipoda, *Hatching, *Seebach River, Austria, *Period of growth, *Light, *Animal physiology, Growth rates, Growth stages, Broods, Clutch, Invertebrates, Diurnal, Timing, Laboratory tests, Larvae, Embryonic growth stage, Insect eggs, Aquatic insects.

Processes of and times required for embryonic development of Ecdyonurus picteti from Seebach River, Austria, were studied under varying light and temperature conditions. Embryonic development is dependent on temperature but not on light. Larvae hatch from eggs which have been laid in one water body in different seasons, at different times. With increasing temperatures, development time decreases. E. picteti was studied in temperatures ranging 6-20 C; the Belehradek Function best fits all results. In constant temperatures, larvae hatch after 50-52 days at 8.4 C. Since eggs in Seebach are exposed to fluctuating temperatures, the influence of diurnal temperature changes on embryonic development time was also examined. In the Seebach with temperature variations 6.2-10.2 C (average 8.2 C), eggs begin to hatch after 47 days. However, under laboratory conditions of temperature variations 5.7-10.9 C (average 8.4 C), the first larvae hatched after 45 days. Special physiological mechanisms accelerate development time under changing temperature conditions and exceed a simple summation of temperature effects. The number of eggs produced by a female varies 1200-7500. Hatching success under constant and fluctuating temperatures per female is 25%. Unfertilized eggs develop at all temperatures tested: development times are one-third longer and those for hatching up to five times as long. Hatching rate per clutch varies 0.1-1.0%. (Danovich-Wisconsin)
W80-02558

INFLUENCE OF THE WATER MITE HYDRACHNA CONJECTA ON THE POPULATION OF THE CORIXID SIGARA STRIATA (HEMIPTERA),
Amsterdam Univ. (Netherlands). Zoological Lab.
C. Davids, M. E. Al, and J. Blaauw.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2613-2616, 3 Fig, 2 Ref.

Descriptors: *Mites, *Water beetles, *Population, *Food habits, *Productivity, *Parasitism, *Laboratory experiments, *Insect behavior, Aquatic insects, Nymphs, Foods, Food abundance, Insect eggs, Broods, Feeding rates, Water temperature, Invertebrates, Fecundity.

Hydrachna conjecta, a water mite whose nymphs and adults feed on water bugs' eggs and whose larvae are parasites of adult water bugs, takes away about 25-35% of corixid Sigara striata egg production. These figures assume a 10% infestation rate. H. conjecta egg consumption averages 191 and 220 eggs/mite when mites are fed 9 and 12 eggs/d, respectively. Average S. striata egg consumption is 4.5 eggs/d in the laboratory; in nature, consumption is probably higher. When nymphs do not receive any food, they do not enter the resting stage between nymph and adult. Several nymphs also perished when fed 1 egg/d. S. striata egg production increases with increasing temperature. Under experimental conditions, mean egg consumption production is 140 eggs/female; at 16-20 C, they produce 16 eggs/wk; in nature egg production might be higher. Infestation rates are also considered, since infested water bugs do not produce eggs. A basic estimate of 10% is chosen although infestation rates in nature are often higher. Mites, therefore, greatly influence water bug populations by consuming up to 35% of their eggs. (Danovich-Wisconsin)
W80-02559

LIFE HISTORY AND DYNAMICS OF A HYDROPSYCHE INSTABILIS CURTIS (TRICHOPTERA, HYDROPSYCHIDAE) POPULATION IN A WEST GERMAN WOODLAND BROOK,
Bonn Univ. (Germany, F.R.). Inst. fuer Landwirtschaftliche Zoologie und Bienenkunde.
N. Caspers.
In: Proceedings: Congress in Denmark, 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2617-2621, 3 Fig, 3 Tab, 20 Ref.

Descriptors: *Katzenlochbach, West Germany, *Phenology, *Life history studies, *Standing crops, *Caddisflies, Population, Seasonal, Ecology, Growth rates, Invertebrates, Biomass, Life cycles, Biorhythms, Productivity, Insect eggs, Hatching, Insect behavior, Turnovers, Aquatic insects.

Phenology, growth pattern, and standing crop of Hydropsyche instabilis (creek-dwelling caddis fly) populations were investigated in Katzenlochbach, a West German woodland brook, January 1976-July 1977. Both Allen curve and instantaneous growth methods yield similar production values of 3.07 and 3.01 g/sq m yr, respectively. Annual turnover ratio, defined as annual production divided by mean annual standing crop, is 3.4. The semivoltine part of the H. instabilis population contributes about one-third of the production rate values. Production rates are compared with those for other creek-dwelling invertebrates. Production rates of predacious species (leeches) are distinctly lower than in H. instabilis, whereas small herbivorous species (Ephemerella subvaria) show the highest production rates. H. instabilis imagines emerges and oviposits in late June and all July. Hatching time lasts from late July to late September. By November most larvae reach third instar

level, the prevailing stage until early spring. From November to February population size drops to 10% of initial size due to high drifting rates. Flight period starts again in late June. Biomass values increase from hatching time throughout autumn months and reaches a 2 g/sq m peak in November. Mean annual biomass of Hydropsyche larvae is 0.91 g/sq m. (Danovich-Wisconsin)
W80-02560

LIFE CYCLE OF LIMNEPHILUS AFFINIS CURT, (TRICHOPTERA: LIMNEPHILIDAE) IN ICELAND AND IN NORTHUMBERLAND, ENGLAND,
Iceland Univ., Reykjavik. Inst. of Biology.
G. M. Gislason.
In: Proceedings: Congress in Denmark, 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, p 2622-2629, 1978. 9 Fig, 7 Ref.

Descriptors: *Life history studies, *Life cycles, *Iceland, *Great Britain, *Caddisflies, *Growth states, *Temperature, Population, Seasonal, Ecology, Phenology, Growth rates, Invertebrate, Aquatic insects, Insect eggs, Hatching, Insect behavior, Reproduction, Period of growth, Geographical regions.

Limnephilis affinis life cycles in Great Britain's temperature climate are synchronized, with oviposition in the autumn and emergence in the spring whereas in Iceland's subarctic climate, oviposition takes place from spring, during summer, and into autumn. In Iceland larval growth takes place in summer and autumn and again in spring and early summer, depending upon hatching times. In Icelandic lowlands, flight periods start in March; adults are still found in October. In Icelandic highlands, flight periods extend from June to August. In England, L. affinis flight periods extend from late April to November. Immature females are found in June, mature in August, and maturing and females after oviposition in September. This indicates that L. affinis females in England undergo ovian quiescence during summer, as described for Limnephilis species in Europe. Water temperatures are much lower in Iceland than in England, and therefore, growth rates in Iceland are much slower. L. affinis growth rates are fastest at 20 C, and slow at 2-5 C. L. affinis larvae from Iceland were collected from Straumsvik Bay, 13 km south of Reykjavik; larvae from Britain were collected from salt marsch pools in Seaton Sluice. (Danovich-Wisconsin)
W80-02561

REGIONAL COEXISTENCE OF FOUR CHAOBORUS SPECIES,
Northern Illinois Univ., De Kalb. Dept. of Biological Sciences.
C. N. Von Ende.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2630-2633, 1 Tab, 8 Ref.

Descriptors: *Diptera, *Habitats, *Size, *Predation, *Vertical migration, *Distribution patterns, Michigan, Speciation, Aquatic insects, Invertebrates, Emergence, Environment, Ecology, Niches, Competition, Adaptation.

Size and distribution patterns of four Chaoborus species that occur in lakes in the Upper Peninsula of Michigan are correlated with predation and with interference competition. Chaoborus americanus, C. flavicans, C. punctipennis, and C. trivittatus were observed. All species except C. americanus occur in lakes with fish and all species in lakes with fish undergo diurnal migration; they are in deep layers during the day and rise close to surface waters at night. Mean C. punctipennis length is 9.3 mm; C. flavicans, 10.8 mm; C. americanus, 12.4 mm; and C. trivittatus, 12.8 mm. Species also differ with respect to recruitment timing. C. americanus emerges in mid-May, C. flavicans at the end of May, C. punctipennis at the end of June, and C. trivittatus at the end of August. Because of its small size and vertical migratory behavior, C. punctipennis is well adapted for lakes without fish. Its early emergence is advantageous for a species found in shallow pools by allowing it to get to the more hardy, later instars as quickly as possible. Its larger size is advantageous in fishless habitats which are usually dominated by larger zooplankton species. The other two species are less parochial. C. flavicans' intermediate size allows it to survive in lakes dominated by either large or small zooplankton. C. trivattatus' vertical migration allows it to survive in fish lakes, and its recruitment timing in certain fishless lakes. (Danovich-Wisconsin)
W80-02562

STUDY OF DYNAMICS OF POPULATIONS OF AQUATIC INSECTS: THE PROBLEM OF VARIABILITY IN LIFE HISTORY EXEMPLIFIED BY TIPULA SACRA ALEXANDER (DIPTERA: TIPULIDAE),
Calgary Univ. (Alberta). Dept. of Biology.
G. Pritchard.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, p 2634-2640. 4 Fig, 3 Tab, 16 Ref.

Descriptors: *Diptera, *Life history studies, *Canadian Rocky Mountains, *Beavers, *Population dynamics, *On-site tests, Population, Aquatic insects, Invertebrates, Life cycles, Variability, Environment, Environmental effects, Testing, Evaluation, Emergence, Ponds, Larvae.

A simple cohort-splitting hypothesis for Tipula sacra (Diptera) populations is not supported by data under all field testing conditions in beaver ponds in the Canadian Rocky Mountains, October 1973-1977. Most temperate latitude aquatic insect populations experience variable growth rates due to changing environmental conditions; individuals from a single egg cohort may complete their development in different years. In order to clarify cohort identification problems, various algebraic and graphical models have been developed. This hypothesis states that most individuals in populations follow either two-year or one-year cycles; it is consistent with data showing two peaks in the emergence curve and two times of year at which recruitment to instar IV occurs. In October 1973, rearing-emergence cages were set up to test the hypothesis. An unplanned test occurred when beaver, which had been absent from the site for 14 years, recolonized ponds in July 1974. The hypothesis is too deterministic in its approach to larval growth predicting greater synchronization than clearly exists. T. sacra populations live in habitats subject to irregular changes and such variability clearly has adaptive consequence. However, life budget productions cannot be achieved even if precise cohort-splitting information if available, unless proportions in various cohorts are determined at all life cycle stages. (Danovich-Wisconsin)
W80-02563

PHENOLOGY OF CHIRONOMUS SPP. IN SALINE LAKES OF CENTRAL BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Zoology.
R. A. Cannings, and G. G. E. Scudder.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2641-2646, 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Emergence, *Diptera, *British Columbia, *Phenology, *Saline lakes, Aquatic insects, Speciation, Mature growth stages, Growth stages, Animal behavior, Insect behavior, Psychological aspects, Ecology, Life cycles, Biorhythms.

Phenology of three Chironomus species at the 1 m depth is compared for seven central British Columbia lakes, May-August 1970, and contrasted with Einfeldia pagana and Glyptotendipes barbipes. When two or more Chironomus species coexist, a very restricted emergence occurs, suggesting some interspecific interactions between species. Chironomus emergence periods, even though very short, are quite different in most lakes. The same species emerges at different times in different lakes. Also, only rarely do two coexisting Chironomus species emerge at the same time. E. pagana and G. barbipes adult emergence occurs May to August. Divergence of emergence patterns in Chironomus species is not seen in E. pagana and G. barbipes emergence patterns; these two species have similar ecologies to Chironomus species and are herbivorous. Lakes occur at the same elevation (1,000 m), and have the similar mean and maximum depths; however, they differ greatly in salinity and ionic composition, ranging 488-11,816 micro mhos in mean conductivity. (Danovich-Wisconsin)
W80-02564

SEASONAL AND BETWEEN YEAR VARIATION IN THE CHIRONOMID LARVAE OF A CHALK STREAM,
Reading Univ. (England). Dept. of Zoology.
J. F. Wright.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2647-2651, 2 Fig, 5 Ref.

Descriptors: *Habitats, *Diptera, *Larval growth stage, *Seasonal, *Annual succession, Larvae, Growth stages, Streams, Great Britain, Substrates, Streambeds, Streamflow, Population, Flow, Density, Macrophytes, Colonization, Low flow.

Chironomid larvae were observed in a chalk stream habitat in southern England, 1971-1976; despite differences in larval density on five stream habitats, between-year variations are of a more substantial nature. Stream habitats include: gravel, detritus, and three macrophytes, Ranunculus, Berula, and Callitriche. Ranunculus is the dominant macrophyte, covering 16.8%-51.6% of the area. Gravel covers 36.5%-53.8%. Macrophytes support higher chironomid densities than other substrates. Greatest between-month stability occurs on Ranunculus. In early spring, Ranunculus is minimal and shows little between-year variation. High discharge between March and May encourages rapid Ranunculus colonization, whereas limited colonization is associated with low discharge. The lowest spring flow occurred in 1976 and by June Ranunculus covered only 35.9% of the stream bed and chironomid densities on this substrate numbered 3,200/0.5 sq m. In contrast, Ranunculus colonized 66.5% of the stream bed in June 1975, following the highest spring discharge; chironomid densities on Ranunculus numbered only 8000/0.05 sq m. Although the percentage of stream bed covered by Ranunculus in early June varies by a factor of two, habitat quality rather than quantity is of greater significance, since between-year variation in chironomid larvae density may differ by more than one order of magnitude. In low discharge years, algae and associated detritus which hold back Ranunculus spring growth, enable high chironomid population densities. (Danovich-Wisconsin)
W80-02565

A CONSOLIDATION MODEL OF SEDIMENTS (LAKE),
Tokyo Univ. of Fisheries (Japan).
S. Kanari.
In: Proceedings; Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2658-2662, 3 Fig, 1 Tab.

Descriptors: *Mathematical models, *Lake Biwa, Japan, *Deposition(Sediments), *Sedimentation, *Consolidation, *Paleohydrology, Equations, Model studies, Curves, Compressibility, Lake Sediments, Sedimentation rates, Stratigraphy, Sediment load, Settling velocity, Diagenesis, Density, Compaction.

Use of a mathematical model for consolidating lake sediments shows that in-situ sedimentation rates in Lake Biwa, Japan in the past 170,000-180,000 years would have been five times as large as present rates. In-situ sedimentation rates at the present bottom surface in Lake Biwa are estimated at 0.2 cm/yr. Ages of nine layers of a Lake Biwa sediment core were determined by carbon-isotopic and fission-track methods. The constant compression

model focuses on consolidation processes at the real lake bottom which differ slightly from Darcy's pore water flow velocity. Succeeding sediment accumulations bring an increasing flow path as well as an increasing pressure gradient in underlying sediments, which cause slight differences in pore water flow. In the model, pore compressiblity at any depth is assumed constant and Lake Biwa core measurements are used to determine equation parameters. Since the true age at every depth is known, in-situ sedimentation rate changes in the past lake bottoms were calculated. (Danovich-Wisconsin)
W80-02567

POLLEN ANALYSIS OF A 200-M CORE SAMPLE FROM LAKE BIWA,
Kanazawa Univ. (Japan). Dept. of Earth Sciences.
N. Fuji.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2663-2665, 2 Fig, 3 Ref.

Descriptors: *Sediments, *Palynology, *Lake Biwa, Japan, *Climatic zones, Geology, Dating, History, Pollen, Spores, Temperature, Vegetation, Plant groupings, Cold regions, Temperate, Climatology.

Existence of six pollen zones ranging from cold to warm climatic stages was established by examining core samples taken from Lake Biwa, Japan. During cold stages, typical vegetation in summit areas near Lake Biwa consist of subalpine plants. In lowland areas, cool temperate plants are present. In warm stages, vegetation in high areas is characterized by plants of the cool temperate and present temperate zone. Lowland vegetation consists of broadleaved deciduous and evergreen trees growing in the warm temperate zone. During the last cold stage, about 17,000 years ago, mean annual temperatures were 7-8 C. The height of the snow-line during that last cold stage was 2,600 m above present sea-level compared to the present snow-line at 4,300 m. Human influence represented by clearing forests and rice-cultivation began 3,000 B.P. Pollen interpretation of the 200 m core and vegetation reconstruction during the last 600,000 years was done by two methods; pollen spectra from modern samples around Lake Biwa and neighboring Japanese Islands, and the warmth index. (Danovich-Wisconsin)
W80-02568

STABLE CARBON ISOTOPE STUDY OF A 200-M CORE SAMPLE FROM LAKE BIWA,
Nagoya Univ. (Japan). Dept. of Earth Sciences.
N. Nakai.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2666-2669, 2 Fig, 8 Ref.

Descriptors: *Lake Biwa, Japan, *Sediments, *Carbon, *Isotope studies, *Palynology, Climatic zones, Cold regions, Temperate, Climatology, Geology, Dating, History, Temperature, Deposition (sediments), Diatoms, Bioindicators, Organic matter, Stable isotopes.

Stable carbon isotopic compositions and organic carbon contents correlate with fossil diatom cell numbers and with palynological climate in a study of a 200 m core sample from Lake Biwa, Japan. Results also show that stable carbon isotope measurements of sedimentary organic materials are sensitive indicators of past climatic changes. Carbon in organic materials has isotopic values ranging -31.8% to -37.9%; total organic carbon contents range 0.3%-1.2%. Value change widely with depth. Smaller carbon isotope values of plankton and sedimentary organic materials tend to occur when climates are colder. Vertical fluctuations in fossil diatoms cell numbers throughout the entire core column are similar to those of organic carbon contents and carbon isotope values. Abundant periods of diatom cells, which are warm or temperate climate, correlate well with high organic carbon and large carbon isotope periods. Therefore, organic carbon amounts in sediments represent production activities when the sediments were deposited. Palynological paleoclimate correlates well with carbon isotope fluctuations. In a warm or temperate climate, organic material production and accumulation rates in bottom sediments are relatively high, resulting in relatively higher carbon isotope enrichment than in cold climatic periods. Ten temperate and 12 cold periods occurred during the last 565,000 years based on the Lake Biwa core column. (Danovich-Wisconsin)
W80-02569

ORGANIC GEOCHEMISTRY-BIOCHEMICAL ORGANIC MATTER,
Nagoya Univ. (Japan). Water Research Inst.
N. Handa.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2671-2673, 1 Fig, 9 Ref.

Descriptors: *Chlorophyll, *Biochemistry, *Organic matter, *Lake Biwa, Japan, *Geochemistry, Carbon, Pigments, Phytoplankton, Population, Geology, History, Sediments, Diatoms, Algae, Plant pigments, Organic loading, Sedimentology.

Chlorophyll derivatives and carotenoids were determined in a 200 m core sample taken from Lake Biwa, Japan; pigment concentration vertical fluctuations coincide with those of ratio values of the sum of carbohydrate, protein, and amino acids and lipid materials carbons (CPL) to total sedimentary organic carbon. Data indicate that lake phytoplankton population abundance has varied in the last 500,000 years. Chlorophyll derivatives in the core sample range 22-374 units/g dry sediment. Allochthonous contribution is minimal while autochthonous phytoplankton is the sole source of sedimentary chlorophyll derivatives. Correlation coefficient for chlorophyll derivatives concentration and the CPL: total organic carbon ratio is 0.88. Relatively high fossil diatoms numbers occur at depths where high values of chlorophyll derivatives and CPL/total organic carbon are found. Diatoms populations are one of the main organic matter producers in Lake Biwa. Algal populations other than diatoms may also have an important role in the lake's organic production. (Danovich-Wisconsin)
W80-02570

SOME BIOLOGICAL PROBLEMS,
Kyoto Univ. (Japan). Dept. of Zoology.
H. Kawanabe.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2674-2677, 1 Fig, 17 Ref.

Descriptors: *Speciation, *Sediments, *Lake Biwa, Japan, *History, *Paleohydrology, Geology, Dating, Cold regions, Temperate, Temperture, Productivity, Deposition(Sediments), Varieties, Phylogeny, Ecology, Environmental effects, Environment, Freshwater, Marine biology, Diatoms,.

This paper discusses dendemism and differentiation of several animal and plant species, based on microfossil data of a core sample taken from Lake Biwa, Japan. Endemic organisms include differentiated in-situ, and relic species. Some fish and crustaceans belong in the differentiated in-situ category, including Cnathopegen caerulescens and Carassius cuvieri (Cyprinidae), Chaenogobius isaza (Gobiidae), and Daphnia biwaensis (Daphniidae). Relic lake species include freshwater, warm water organisms (Opsariichthys uncirostris uncirostris): freshwater cold water organisms (Valvata biwaensis); marine warm water organisms (Corbicula sandai): and marine cold water organisms (Kamaka biwae). Melosira juergensi, a marine brackish-water diatom species, is found in several parts of the core, suggesting that the lake was brackish during several interglacial ages. All Stephanodiscus diatoms abruptly change at 110 m in depth. S. carconensis and S. pusilla are found only above 110 m, whereas S. astea and S. minutula are found only below 110 m. Just at 110 m, a large volcanic ash layer 100 mm in thickness occurs. Ash-sorting indicates that eruption occurred during a rather short time; environmental factors changed greatly and most orgamisms were probably on the verge of extinction. At 90 and 100 m depth layers, cell diatom and green algae numbers are very small. On the contrary, production rate is high due to large amounts of chlorophyll derivatives, suggesting shallow lake conditions and submerged plant dominance. (Danovich-Wisconsin)
W80-02571

SEASONAL CYCLES IN THE PHYTOPLANKTON PHOSPHORUS STATUS OF A NORTH TEMPERATE ZONE LAKE (LAKE MEMPHREMAGOG, QUE-VT), PLUS A COMPARISON OF TECHNIQUES,
Mcgill Univ., Montreal (Quebec). Dept. of Biology.
J. L. Sproule, and J. Kalff.
In: Proceedings; Congress in denmark, 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2681-2688, 5 Fig, 1 Tab, 18 Ref.

Descriptors: *Phosphorus, *Phytoplankton, *Analytical techniques, *Lake Memphremagog, Quebec, Canada, Phosphates, Nutrients, Limiting factors, Lakes, Kinetics, Nutrient requirements, Seasonal, Temperate, Cycling nutrients, Algae, Water quality, Phosphorus compounds, Deficient elements, Essential nutrients.

Four techniques for measuring algal phosphorus (P) status were compared and used to investigate seasonal P deficiency patterns in Lake Memphremagog, a 40 km long, narrow glacial lake located on the Quebec (Canada)-Vermont (US) border, August 1973-October 1975. The four techniques are: alkaline phosphatase activity (APA), phosphate uptake rate, saturated rate of phosphate uptake (V-max), and boiling water extractable phosphorus (surplus P). Although any of the first three methods combined with surplus P data describe phytoplankton P status, APA makes radioactive isotopes unnecessary and is quick, simple and low cost. The lake exhibits an axial gradient in P deficiency in lake summer and early fall, with greatest and smallest deficiency in north and south lakes sections, respectively; the gradient closely couples the total P concentration gradient. APA, phosphate uptake rates and V-max follow similar seasonal trends, despite changes in phytoplankton composition. While the winter community exhibits no P limitation the community is normally characterized by high APA, phosphate uptake rates and V-max. These measures decline most significantly in P-rich southern lake areas during late summer, indicating an increased P supply, which is also reflected by increased biomass (chlorophyll-a). Surplus P was detected only during the fall, when biomass declined, and in spring. Average lake APA was 53% greater during late summer and fall 1974, than during the same period in 1975. (Danovich-Wisconsin)
W80-02572

INTERDEPRESSION DIFFERENCES IN THE HYPOLIMNETIC AREAL RELATIVE OXYGEN DEFICITS OF DOUGLAS LAKE, MICHIGAN,
Baylor Univ., Waco, Tx. Dept. of Biology.
O. T. Lind.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2689-2696, 2 Fig, 3 Tab, 17 Ref.

Descriptors: *Douglas Lake(MI), *Eutrophication, *Oxygen, *Hypolimnion, *Land use, Organic matter, Environmental effects, Dissolved oxygen, Oxygen demand, Oxygen requirements, Regression analysis, Degradation(Decomposition), Carbon, Primary productivity, Lakes, Depth, Bathymetry, Water properties, Land development, Recreation.

Hypolimnetic oxygen deficits among depressions in Douglas Lake, Michigan, June-July 1971, do not support a hypothesis of greater allochthonous and autochthonous organic loading at the west end of the lake near Fairy Island depression where land development is concentrated. However, three

kinds of analysis suggest that eutrophication is accelerated relative to lake and lake shore use: comparisons of hypolimnetic areal relative oxygen deficiets among lake depressions; comparison of South Fishtail Bay oxygen deficit data with that of previous years; and comparisons with primary production data. Three major depressions in Douglas Lake were observed; Fairy Island depression (FID), Grapevine Point depression (GPD), and South Fishtail Bay degression (SFBD) which are located in western, central and eastern lake sections, respectively. Mean dissolved oxygen concentrations in hypolimnion layers vary from 4.07 (FID), 4.25 (GPD), and 3.29 mg/l (SFBD) on June 24 to 0.33 (FID), 0.17 (GPD), and 0.20 mg/l (SFBD) on July 29. Oxygen loss rate is only 0.062 mg oxygen/sq cm d (GPD) compared to 0.097 (FID) and 0.102 mg/sq cm d (SBFD). Less oxygen demand in mid-lake GPD than either of the other depressions. Total organic Carbon content is initially much greater in both FID and SFBD than GPD; however, a linear decline occurs in SFBD so that the final SFBD content is similar to that of GPD. (Danovich-Wisconsin)
W80-02573

EFFECT OF A PUMP-STORAGE HYDRO-ELECTRIC SCHEME ON THE STRATIFICATION AND ECOLOGY OF A SCOTTISH LOCH,
Glasglow Univ. (Scotland). Dept. of Zoology.
R. Trippett.
In: Proceedings, Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2697-2700, 3 Fig, 2 Ref.

Descriptors: *Loch Awe, Scotland, *Pumped storage, *Environmental effects, *Ecology, *Thermal stratification, *Electric powerplants, Entrainment, Reservoir operation, Plankton, Phytoplankton, Zooplankton, Population, Biological communities, Primary productivity, Productivity, Electric power, Stratification, Pumping, Succession, Speciation, Shannon-Wiener Diversity Index.

Results of 1975-1976 studies of affects of the Cruachan Pump-Storage powerplant on limnology of Loch Awe, North Scotland show that productivity is reduced in the plant vicinity; effects include lower plankton populations, peak populations, and zooplankton diversity, and deepened thermocline. Loch Awe is 24 sq km; north and south basins are 75 and 94 m deep, respectively. The power station was built on the north basin in 1968. At the beginning of stratification, effects of mixing from the pumped storage deepen the thermocline from 8 to 12 m and make the metalimnion sharper. In the south basin, phytoplankton grow rapidly in mid-May. Zooplankton growth shows three peaks throughout the summer and a succession of organisms from copepods (April-May) to rotifers and Cladocera (June-August). The Shannon-Weiner Index of community diversity shows that phytoplankton diversity fell rapidly in spring but steadily increased throughout the summer to 3.5 in October. Zooplankton community diversity in the south basin is slightly higher in late spring and summer (2.8) than in October (1.8). In the north basin, phytoplankton experienced a smaller peak population which also took longer to develop. Increased water circulation, instituted by the power station, increases the epilimnion layer which means that populations are dispersed through a greater water depth. Zooplankton diversity is consistently lower, indicating that zooplankton either avoid the power station or passage through turbines is detrimental to populations. (Danovich-Wisconsin)
W80-02574

EFFECTS OF SEWAGE DIVERSION IN LAKE SODRA BERGUNDASJON. II. PHYTOPLANKTON CHANGES AND THE ROLE OF NITROGEN FIXATION,
Lund Univ. (Sweden). Limnological Inst.
L. Leonardson, and L. Bengtsson.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2701-2707, 1 Fig, 2 Tab, 22 Ref.

Descriptors: *Nitrogen fixation, *Phosphorus, *Cyanophyta, *Sewage diversion, Lake Sodra Bergundasjon, Sweden, Sweden, Nitrogen, Cycling nutrients, Nutrients, Phosphates, Microcystis, Anabaena, Aphanizomenon, Waste water treatment, Pollution abatement, Eutrophication, Lake renewal, Lakes, Phytoplankton.

Nitrogen fixation is shown to maintain phytoplankton blooms after sewage diversion. Lake Sodra Bergundasjon, Sweden received wastewater from the city of Vaxjo from 1927 to 1974, after which almost all sewage effluent was diverted from the lake to eliminate the serious pollution effects. The reduced input of nutrients after sewage diversion resulted in decreased mean annual concentrations of total N and total P, but phosphate concentrations remained high due to sediments release. After 1974, combined inorganic N became growth limiting during the summers and there was a drastic change from an almost total dominance of Microcystis to N2 fixing species of Anabaena and Aphanizomenon. N2 Fixation went from 0% in 1974 to 51% and 82% of total N input during the growing seasons in 1975 and 1976 respectively. This N2 fixation together with the high phosphate and phosphorus concentration resulted in a high biomass of blue-green algae after the sewage diversion. As long as there is an excess of available P and other nutrients, it is of no use to build advanced treatment plants for N removal. In the short run, the diversion of sewage effluents is not sufficient to avoid plankton blooms unless the release of P from the sediment can be repressed or the water renewal time is very short. (Luedtke-Wisconsin)
W80-02575

THEORETICAL CONSIDERATIONS ON EUTROPHICATION,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
M. Straskraba.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2714-2720, 5 Fig, 1 Tab, 11 Ref.

Descriptors: *Theoretical analysis, *Graphical analysis, *Eutrophication, IBP-PF analysis, Curves, Nutrients, Phytoplankton, Temperature, Light, Model studies, Photosynthesis, Phosphorus, Limiting nutrients, Latitudinal studies, Chlorophyll-a.

The asymptotic relationship of phytoplankton and phosphorus is re-analyzed using published empirical data, and extends the IBP-PF analysis. Phytoplankton and P are quantified as concentration (chlorophyll-a, total phosphorus, orthophosphate) or by primary productivity and load. Theoretical reconstruction of primary productivity variations along the geographical latitude axis is accomplished by plotting the theoretically obtained annual integral of photosynthetic capacity against latitude. Examination of these examples suggests that productivity in a water body is realized within space of at least five major complex axes: nutrients, geography, morphometry and optical qualities of water, hydrology, and biological interactions of populations. To analyze this complex productivity problem, a multiple-resources kinetics model is proposed embodying the following components: (1) resources most markedly affecting phytoplankton photosynthesis are light, limiting nutrient, temperature, and biomass of the phytoplankton populations; (2) functional responses to the resources named are mutually interrelated; and (3) parameters of the existing functional response-kinetic single resource models are analytical functions of other resources. The multiple-resources kinetics model is graphically illustrated with a multidimensional representation by means of two three-dimensional spaces, the second of which must be inserted into the first. On the basis of this model it is postulated that observed changes in light intensity have nothing in common with light adaption, but are an artifact due to inadequate photosynthetic models. (Luedtke-Wisconsin)
W80-02576

PHOSPHORUS UPTAKE RATES IN PLANKTONIC COMMUNITIES RELATED TO LIGHT GRADIENT,
Quebec Univ., Montreal. Dept. of Biology.
D. Planas.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 2, Part 4, 1978. p 2731-2736, 6 Fig, 13 Ref.

Descriptors: *Phosphorus uptake, *Algae, *Bacteria, *Light intensity, *Absorption, *Phosphorus, Lakes, Hypolimnion, Epilimnion, Lake 302(Canada), Southern Indian Lake(Canada), Canada, Cycling nutrients, Light.

The relative importance of algae and bacteria in lake dynamics are assessed by means of a hypothesis which states that if cells are light-stimulated, phosphorus demand will decrease when cells are in darkness. Two Canadian lakes were studied: Southern Indian Lake, a shallow, unstratified lake, and Lake 302 in the Experimental Lakes Area, a small, summer stratifed lake in which the vertical plankton distribution in the hypolimnion shows an algal peak and a bacteria peak. Sampling was done in three layers: the epilimnion which is very phosphorus deficient; the hypolimnion region with dominant algae; and the hypolimnetic bacterial region. Results indicate that the P uptake does not follow the Michaelis-Menton equation when measured in a wide range of light intensities. Two peaks always occur, one at low light intensities or in the dark, and one at a high intensity. The curve shape of P uptake plotted against light gradient for the hypolimnion samples of Lake 302 is different from those of the Southern Indian Lake samples, but follows the same pattern. The plot of 1/I versus 1/V gives two slope figures; positive for the higher light intensity and negative for the lower. The presence of two peaks or slopes in these plots suggest a phenomenon associated with two different populations which could be related to autotroph and heterotroph organism. The two maxima show some relation with the light measured in the biotope at the moment of sampling and occurred between the 5% to 20% of the surfaces irradiance in the higher and under 0.5% of the peak in the lower. (Luedtke-Wisconsin)
W80-02578

ABSENCE OF PRIMARY PRODUCTION IN SHALLOW OLIGOTROPHIC POND,
North-Eastern Hill Univ., Shillong (India). School of Life Sciences.
J. R. B. Alfred, and N. T. Chellappa.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978. p 2737-2742, 1 Fig, 2 Tab, 26 Ref.

Descriptors: *Primary productivity, *Cycling nutrients, *Diurnal, Phytoplankton, Zooplankton, Nutrient uptake, Eutrophication, India, Bioassay, Oligotrophy, Shillong(India).

Relationships between nutrients and phytoplankton and between phytoplankton and zooplankton are explored during a diurnal period where sunrise to sunset was approximately 12 hours, in contrast to most bioassay and nutrient enrichment experiments which are done seasonally or for short periods of incubation. The experiments were conducted in a shallow oligotrophic pond in Shillong, India. It was hypothesized that as nutrients were added, phytoplankton biomass and zooplankton would increase proportionally. However, results indicate no primary productivity or diurnal rhythm. Respiration was more or less constant for all concentrations of all nutrients. In the enrichment studies, there was an immediate uptake of all concentrations of nutrients which continued at the same level throughout the diurnal period. It is suggested that though a nutrient supply is essential for primary production, the relationship often is not obvious. High assimilation rates coincide with low contents of ammonia, silicate, and nitrogen, which may simply be due to the exhaustion nutrients because of their rapid consumption by the algae. A possible explanation is that enclosed algae could be shut off from any nutrient regenration and therefore create a nutrient limitation not existing in the natural system. (Luedtke-Wisconsin)
W80-02579

REMOVAL OF OIL FROM AN OIL IN WATER EMULSION,
Imperial Chemical Industries Ltd., London (England). (Assignee).
D. B. Chambers.
U.S. Patent No 4,168,229, 4 p, 20 Ref; Official Gazette of the United States Patent Office, Vol 986, No 3, p 661-662, September 18, 1979.

Descriptors: *Patents, *Water pollution treatment, *Oil pollution, *Separation techniques, Zeta potential, Coagulation, Water quality control, Metal fibers.

A method for the removal of oil from an oil in water emulsion comprises contracting the emulsion with a fibrous structure comprising inorganic fibres which, in the emulsion, have a positive zeta potential, and removing the coalesced oil droplets so formed. It is though that the oil droplets being negatively charged, are attracted to the surface of the individual inorganic fibres in the fibrous structure and coalesce forming larger droplets which detach themselves from the fibrous structure. The larger droplets so formed can then conveniently be separated by allowing the droplets to float to the surface to form a layer of oil which can be removed. (Sinha - OEIS)
W80-02615

ENVIRONMENTAL POLLUTION FROM HIGHWAY DEICING COMPOUNDS,
Maine Univ. at Orono.
F. E. Hutchinson.
Journal of the New England Water Works Association, Vol 93, No 2 p 127-135, June, 1979. 1 Fig, 3 Tab, 7 Ref.

Descriptors: *Deicers, *Sodium chloride, *Highways, *Environmental effects, Soil contamination, Water pollution, Vegetation effects, Water wells, Ponds, River, New England.

Between 15 and 25 tons per mile of salt are supplied to highways in northern states each winter. This resuts in sodium contamination of soils that threatens vegetation and soil drainage, and chloride contamination of wells and ponds, but has no measureable effect on rivers. At the present time there are no acceptable alternatives to sodium chloride for deicing highways. However, the following steps can be taken to minimize further damage to the roadside environment: (1) Avoid drilling wells too close to highways; (2) Reduce salt use through metering; (3) Select salt-tolerant vegetation for planting along highways; and (4) Exchange sodium ions in soil with calcium ions by applying lime along highways. (Purdin-NWWA)
W80-02657

DISPERSION MODELING IN TIME AND TWO DIMENSIONS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W80-02664

DYNAMICS OF DISSOLVED OXYGEN IN A HYPEREUTROPHIC LAKE: LAKE KASUMIGAURA, JAPAN,
Tsukuba Univ. (Japan). Inst. of Biological Sciences.
For primary bibliographic entry see Field 2H.
W80-02684

5D. Waste Treatment Processes

ADSORPTION OF FREE AND COMPLEXED METALS FROM SOLUTION BY ACTIVATED CARBON,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
A. J. Rubin, and D. L. Mercer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127244, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, Ohio State University, Report, August 1979. 68 p, 12 Fig, 7 Tab, 51 Ref. OWRT A-044-OHIO(1).

Descriptors: *Waste treatment, *Water treatment, *Activated carbon, *Adsorption, *Metals, Cadmium, Zinc, Lead.

Investigated was the effect of two complexing agents of different solubilities on the adsorption of cadmium(II), zinc(II) and lead(II) by activated carbon. Studies were run to compare carbons of different isoelectric points, particle size and dosage. The Freundlich and Langmuir isotherms were compared as were curve fitting techniques for evaluating the adsorption parameters. Uncomplexed metals were only slightly removed, the extent of which depended on solution pH and the pK1 of the metal. At very low surface coverage, as with an excess of adsorbent, EDTA appears to enhance the sorption of cadmium. Under more realistic conditions, that is, at high surface coverages, the effect of this soluble chelating agent is to suppress adsorption of metal ion. Therefore, it was concluded that the use of EDTA is detrimental to metals removal. It can be further concluded that complexation with relatively insoluble chelating agents such 1,10-phenanthroline can significantly promote metals removal by activated carbon. There are several limitations to the Langmuir model for representing equilibrium adsorption data, however, the Freundlich equation is even less successful. The chief utility of the Langmuir isotherm is in the use of its parameters Xm and K for the comparison of adsorbents and adsorbates.
W80-02406

POLIOVIRUS TYPE I REMOVAL BY MONTMORILLONITE CLAY,
California Univ., Los Angeles. Dept. of Chemical, Nuclear and Thermal Engineering.
For primary bibliographic entry see Field 5B.
W80-02408

TREATMENT OF EFFLUENTS,
Matthey Rustenburg Refiners (Pty) Ltd., Johannesburg (South Africa). (Assignee).
J. J. MacGregor.
U.S. Patent No 4,162,950, 3 p, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 5, p 1189, July 31, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Metals, Separation techniques, Hydrogen ion concentration, Temperature, Electrolysis, Chemical precipitation, Product recovery, Platinum group metals.

Certain very stable and soluble compounds of metals are sometimes encountered which resist all normal chemical and elctrochemical attempts to remove them from solution. In the case of platinum group metals, the high intrinsic value makes such small trace quantities worth recovering. In other cases recovery may be required to prevent infringement of effluent discharge limits. The process for recovering platinum group metal present as a stable complex dissolved in an aqueous effluent from a platinum group metals refinery comprises (1) adjusting the pH of the effluent to an alkalinitz of at least 10; (2) heating to above 60C; (3) electrolyzing the effluent using an anode potential having a half-cell voltage of at least 7.5 volts and current density of at least 0.2 A/sq cm so as to break down the complex by anodic oxidation and precipitate metal present in the complex; and (4) filtering off the precipitated metal. (Sinha-OEIS)
W80-02447

METHOD FOR TREATING PLANT EFFLUENT,
Entenmann's, Inc., Bay Shore, NY. (Assignee).
H. Keoteklian.
U.S. Patent No 4,173,532, 17 p, 6 Fig, 1 Tab, 6 Ref; Official Gazette of the United States Patent Office, Vol 988, No 1, p 176, November 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, Flocculation, Coagulation, Hydrogen ion concentration, Biochemical oxygen demand, Polyelectrolytes, Bakery effluents, Sugars, Starches.

The method of this invention broadly includes the sequential treatment of liquid industrial effluent with acidic and alkaline coagulants and cationic and anionic polyelectrolytes in a clarifier unit. The effluent is treated by the addition of an acidic coagulant to lower the pH and to enhance the removal of starches and sugars. The addition of acidic coagulant may be performed just prior to or at the entry of the effluent to the clarifier unit; alternatively, the acidic coagulant may be added to the liquid effluent while the effluent is in a holding tank. Once in the clarifier system, the effluent is treated by addition of an alkaline substance to raise the pH, thereby causing a voluminous and heavy floc to form in the clarifier. Another acidic coagulant is then added to the effluent in the clarifier for lowering the pH and for additionally forming floc. Anionic and cationic polyelectrolytes may be added to the clarifier at this point to enhance the ability of the floc to remove colloial materials. The heavy flocs and precipitates are removed from the bottom of the clarifier, while lighter flocs and precipitates are collected in a separate region. The remaining effluent, which is substantially free of waste materials can be either released to a suitable ground or surface receiving system or can to subjected to additional treatments before release. (Sinha-OEIS)
W80-02469

WASTE WATER PURIFICATION,
Standard Oil Co., Chicago, IL. (Assignee).
R. C. Mallatt, J. D. Walk, and J. F. Grutsch.
U.S. Patent No 4,168,288, 9 p, 1 Fig, 15 Ref; Official Gazette of the United States Patent Office, Vol 986, No 3, p 661, September 18, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, *Separation techniques, Water purification, Activated carbon, Filtration, Aeration, Recycling, Regeneration.

An improved process for the treatment and purification of waste water comprises the use of primary, intermediate, and secondary treatment but tertiary treatment may also be included. Powdered activated carbon is used in the secondary treatment with recycle to any or all of the primary, intermediate or secondary treatment stages. Regeneration of used powdered activated carbon is also provided. In some cases, the improved process for the purification of waste water comprises feeding the waste water to a first clarification zone where easily removed solids are separated from the water; passing the effluent to a filtration of air flotation zone where suspended solids and colloidal matter are separated from the water; passing the effluent to an aeration zone where the water is contacted with activated sludge and powdered activated carbon, and oxygen is introduced; passing the effluent to a second clarification zone where purified water is separated from the sludge and carbon; recycling a first portion of the separated sludge and carbon from the second clarification zone to the filtration zone effluent; recycling a second part of the separated sludge and carbon to the first clarification zone effluent; and passing purified water from the second clarification zone. (Sinha - OEIS)
W80-02614

METHOD AND APPARATUS FOR RECYCLING WATER IN A CAR WASH,
For primary bibliographic entry see Field 3E.
W80-02616

WASTE WATER PURIFYING PROCEDURE,
Enso-Gutzeit Osakeyhtio, Helsinki (Finland). (Assignee).
M. Salkinoja-Salonen.
U.S. Patent No 4,169,049, 7 p, 2 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 986, No 4, p 944, September 25, 1979.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, Industrial wastes, Aromatic compounds, Pulp and paper wastes, Chlorine, Phenols, Bacteria, Anaerobic conditions, Aeration, Biofilters.

A waste water purifying procedure is intended to be used in treatment of waste water containing aromatic compounds. In a biofilter in a layer containing bark of wood there is formed a bacterial population comprising one or several of the bactery strains deposited in the Universite of Helsinki Institute of General Microbiology under the deposition codes YM 134-202 and YM 241-268. The bacterial population was formed by packing into biofilters, crushed coniferous tree bark and bacteriferous water, ooze, mud or bark residues taken from a water body polluted by chlorinated and unchlorinated phenols and by aromatic carboxylic acids and by thereafter feeding into the biofilters water containing these substances, whereby the bactery strains are characterized by tolerance of the presence of chlorinated and unchlorinated phenols and of aromatic carboxylic acids. The waste water to be purified is conducted through the biofilter where the waste water is purified by effect of action of the bactery population. The purification may be carried out by conducting the waste water through three consecutive tanks. In that case anaerobic conditions are provided in the middle tank and the first and last tanks are biofilters, into which air is appropriately introduced for maintenance of bacterial activity. (Sinha-OEIS)
W80-02622

BUOYANT CONTACT SURFACES IN WASTE TREATMENT POND,
Solar Aquasystems, Inc., Encinitas, CA. (Assignee).
S. A. Serfling, and D. Mendola.
U.S. Patent No 4,169,050, 9 p, 4 Fig, 17 Ref; Official Gazette of the United States Patent Office, Vol 986, No 4, p 944, September 25, 1979.

Descriptors: *Patents, *Waste water treatment, *Biological treatment, *Settling basins, Aeration, Aquatic plants, Solar radiation, Food chains, Biological communities, Temperature.

A wastewater treatment and reclamation system uses natural ecological processes consisting of ponds; greenhouse pond cover; pollution-consuming, floating aquatic plants; high-surface-area, submerged, activated bio-web substrates for greatly increasing fixed bacterial film area and activity; aeration co-functioning with the bio-web substrate for accelerating bacterial metabolism and/or solar heat transfer, mixing and aerating the water body; and a polyculture of micro-invertebrates, fish and shellfish providing a balanced food chain for maximum removal and bio-concentration of nutrients and organics from the wastewater. (Sinha-OEIS)
W80-02623

METHOD OF TREATING WASTE WATERS CONTAINING SOLID-PHASE DIFFICULTLY-SOLUBLE COMPOUNDS,
Nippon Electric Co., Ltd., Tokyo. (Assignee).
N. Sakakibara, S. Ohno, and S. Shimizu.
U.S. Patent No 4,169,053, 4 p, 8 Ref; Official Gazette of the United States Patent Office, Vol 986, No 4, p 945, September 25, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Separation techniques, Heavy metals, Chemical reactions, Suspended solids, Chemical precipitation.

A method is provided for treating waste water containing solids of difficultly-soluble compounds of at least one heavy metal. The method comprises the steps of adding an amount of ferrous ions to the waste water corresponding on a molar basis to about 2 to 100 times the total molar amount of heavy metal present in the waste water, adding an alkaline substance in an amount corresponding to about 0.9 to 1.2 equivalent of free acid present in the waste water, and stirring the waste water without aeration at a temperature of at least about 40C. The insoluble ferrite crystals with the heavy metal incorporated within them are precipitated. (Sinha-OEIS)
W80-02624

PROCESS FOR CONCENTRATING AND PURIFYING AQUEOUS SULPHURIC ACID SOLUTIONS,
Montedison S.p.A., Millan (Italy). (Assignee); and Escher Wyss A. G., Zurich (Switzerland).
F. Cappello, M. Mortigliengo, E. Schmoll, and E. Kratz.
U.S. Patent No 4,169,054, 3 p, 3 Ref; Official Gazette of the United States Patent Office, Vol 986, No 4, p 945, September 25, 1979.

Descriptors: *Patents, *Waste water treatment, *Pollution abatement, *Separation techniques, Chemical wastes, Evaporation, Filtration, Metals, Sulfur compounds, Product recovery, Metal pickling industry, Sulfuric Acid.

Concentrated sulphuric acid aqueous solutions, stably clear through the time, are obtained starting from diluted sulphuric acid aqueous solutions containing Mg and possibly other impurities such as Fe, Al, Cr, V and Mn, by evaporation concentration. The process is characterized in that, before filtering, the slurry obtained by evaporation concentration, is cooled down to 10-25C. and maintained at this temperature for not less than 12 hours. (Sinha-OEIS)
W80-02625

APPARATUS AND PROCESS FOR VOLUME REDUCTION OF AQUEOUS WASTE THROUGH SOLAR EVAPORATION,
Waste Management, Inc., Oak Brook, IL. (Assignee).
V. R. Johnson, Jr., and W. O. Hagerman.
U.S. Patent No 4,169,791, 7 p, 6 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 987, No 1, p 169, October 2, 1979.

Descriptors: *Patents, *Waste water treatment, *Waste water disposal, *Evaporation, Industrial wastes, Heavy metals, Solar radiation, Settling basins, Equipment, Hazardous wastes.

A lagoon containing aqueous waste to be volume reduced is provided with a cover having one or more segments, each of which is mounted upon a frame and movable from a covering position to a position adjacent the lagoon. During fair weather, the cover is positioned adjacent the lagoon and liquid waste is pumped from the lagoon and dispersed over the surface of the cover. When inclement weather approaches, the pumping of the waste is ceased, the surface of the cover cleaned by flushing with clean water, and the cover moved into position over the lagoon to prevent precipitation from diluting the waste liquid. The invention is particularly useful in areas of low net evaporation rate. (Sinha-OEIS)
W80-02630

ENVIRONMENTAL, SMALL-PART CONTINUOUS WASHING PROCESS,
Mannor (J. S.) Machine Corp., Woodstock, IL. (Assignee).
M. Norman.
U.S. Patent No 4,170,488, 10 p, 5 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 987, No 2, p 407, October 9, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial water, Water pollution, Water reuse, Recirculated water, Conservation, Metal washing processes.

This process concerns a drum-type continuous washer for small parts. These parts, requiring oil or soil removal, are tumble washed. The continuous washing and rinsing process comprises a substantially closed chamber utilizing a hot, wash water collecting tank receiving, for recycling, condensate rinse and liquid spray run off from the process. It utilizes a compression section drawing in the steaming air from within the closed chamber for recycling. The tank included in a liquid path effects pressure spray impingement on the parts. The compression section included in a hot air path produces wet air by compression condensation of steam in air. The wash water in the collecting tank is maintained at a predetermined steaming temperature range and the blown condensed water is reintroduced into the heated tank for recycling. Each of the steps is performed in a closed chamber to minimize escape of heat, wash liquid, air, steam, rinse, and inhibitor. The recycling of wash liquid is also in a closed chamber to minimize escape of wash liquid. (Sinha-OEIS)
W80-02635

PROCESS FOR REDUCING AQUEOUS EFFLUENTS CONTAINING ENVIRONMENTALLY UNACCEPTABLE COMPOUNDS FROM A PROCESS FOR GASIFYING CARBONACEOUS MATERIALS,
Koppers Co., Inc., Pittsburgh, PA. (Assignee).
J. F. Kamody.
U.S. Patent No 4,170,550, 11 p, 2 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 987, No 2, p 425-426, October 9, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Recycling, Oxidation, Chemical reactions, Gases, Coal gasification wastes, Scrubbers.

Aqueous effluents from a process for gasifying carbonaceous materials may contain environmentally unacceptable compounds like hydrogen cyanide, ammonia, and ammonia compounds, dissolved salts and compounds of heavy metals and sulfur compounds. These compounds are removed from the aqueous effluents of the process by recycling the effluents to the gasifier where the compounds are oxidized, reduced, or decomposed into environmentally innocuous compounds that can be released to the atmosphere or removed from the gasification process in the residue. (Sinha-OEIS)
W80-02637

WASTE OIL RECOVERY UNIT,
British Petroleum Co. Ltd., London (England). (Assignee).
D. Honour.
U.S. Patent No 4,170,551, 4 p, 1 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 987, No 2, p 426, October 9, 1979.

Descriptors: *Patents, *Oil pollution, *Water quality control, *Waste treatment, Separation techniques, Oily water, Water pollution sources, Equipment, Bilge water, Oil wastes.

Waste oil on board ship is disposed of usefully by burning in the ship's steam raising boiler. Apparatus for rendering the waste oil burnable comprises a tank with waste oil and fuel oil inlets, a tank heater, a drain pipe and filter for separated water, an agitator, an external pipe and pump and pump for recirculation of waste oil and fuel oil through the turn and a bleed off pipe from the external pipe to the ship's boiler fuel supply line. Other liquid or finely powdered organic waste (e.g. kitchen waste) may also be disposed of in the system. (Sinha-OEIS)
W80-02638

METHOD FOR COALESCING MERCURY PARTICLES,
Anic S.p.A., Palermo (Italy). (Assignee).
G. Generini.
U.S. Patent No 4,170,552, 3 p, 4 Ref; Official Gazette of the United States Patent Office, Vol 987, No 2, p 426, October 9, 1979.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, Industrial wastes, Separation techniques, Mercury, Coalescence, Magnetic fields.

Mercury particles which are difficult to strip from sewage waters of industries employing mercury compounds, due to their extremely tiny size, can be coalesced into larger mercury drops by applying a strong magnetic field to the liquor which contains such tiny particles. (Sinha-OEIS)
W80-02639

PROCESS AND APPARATUS FOR THE CONTROLLED FLOCCULATING OR PRECIPITATING OF FOREIGN SUBSTANCES FROM A LIQUID,
GSI-Regeltechnik G.m.b.H (Germany, F.R.). (Assignee).

H. Lang, H. Overath, and H-W. Priester.
U.S. Patent No 4,170,553, 19 p, 11 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 987, No 2, p 426, October 9, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Domestic wastes, Separation techniques, Flocculation, Turbidity, Phosphates, Chemical precipitation, Equipment.

This invention relates to a process for the controlled flocculating or precipitating of foreign substances from waste water by the addition of a flocculating agent, at least a partial quantity of the liquid being treated with a dosed amount of the flocculating agent. The flocculation or precipitation caused in the partial quantity is measured by a turbidity measurement. The addition of the floccualting agent to the waste water is determined on the basis of the turbidity measurement. The apparatus for carrying out the process also constitutes the object of this invention. (Sinha-OEIS)
W80-02640

WASTEWATER TREATMENT METHOD,
United Aricraft Products, Inc., Dayton, OH. (Assignee).
I. G. Freshcorn.
U.S. Patent No 4,170,554, 5 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 987, No 2, p 426-427, October 9, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, *Water quality control, *Separation techniques, Chemical precipitation, Chromium, Fluorides, Settling basins, Water purification.

A system of wastewater treatment is specifically improved in at least three areas. These conclude the carrying out of a continuous sensing of water quality in rinse tanks, with fresh water added as required to avoid contamination extremes which may make subsequent treatment difficult. In a second area of improvement, chromium and fluoride bearing wastewater is mixed in a common chamber to which is added a precipitant for simultaneous precipitation of the chromium as chromium hydroxide and of the fluorides as calcium fluoride. The pH in such chamber is carefully controlled to remain above an acidity level and below a level at which trivalent chromium will revert to hexavalent chromium. In a third area of improvement, treated wastewater is directed to a clarifier by way of a settling basin for a separating out of precipitated solids. Settled solids from the clarifier are returned to the settling basin for efficient separation with minimal water handling. Wastewater from other plant sources may also be directed to the clarifier, joining the metallic and salts bearing rinse water through at least a part of its treatment process. (Sinha-OEIS)
W80-02641

APPARATUS FOR RECOVERY OF METALS FROM METAL PLATING BATHS AND NEUTRALIZING TOXIC EFFLUENTS THEREFROM,
Instytut Mechaniki Precyzyjnej, Warsaw (Poland).
F. Tuznik, and A. Lis.
U.S. Patent No 4,171,255, 6 p, 1 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 987, No 3, p 680, October 16, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Metals, Separation techniques, Oxidation, Chemical precipitation, Filtration, Neutralization, Conservation, Product recovery, Metal plating industry, Cyanide.

A method and apparatus is provided for thorough neutralization of all plating bath solutions and effluents and for full recovery of used plating metals. Hexavalent chromium is reduced to trivalent chromium with production of chromium hydroxide. Metals such as zinc and cadmium are recovered as their respective hydroxides; silver and copper are recovered as free metals. The pH of the reclaiming bath is adjusted from 3.0 to 13.0, and an aldehyde, and/or ozone, is introduced into the reclaiming bath. The aldehyde may be introduced in the form of an aldehyde or an ammonium aldehyde. The fumes from the reclaiming tank are introduced into the fume extraction ducts which carry cyanide fumes in the form of hydrogen cyanide. The apparatus comprises three interconnected units. The first unit comprises the equipment for introducing the reagents into the reclaiming bath. The second unit comprises several tanks, or several chambers within one tank, which include equipment for filtration and precipitation within the closed-loop system of the plating bath and the reclaiming bath. The third unit comprises the reactor for pH adjustment and the water recovery installation, including piping and control systems. As filtration and purification of the plating bath, the reclaiming bath, and the rinse water are carried out within the closed-loop system, consumption of fresh water is reduced to 2-10%. (Sinha-OEIS)
W80-02643

PRESSURIZED OXYGENATION OF SEWAGE,
FMC Corp., San Jose, CA. (Assignee).
T. E. Roberts, Jr., B. M. Wright, C. D. Watson, and J. A. Abbott.
U.S. Patent No 4,171,263, 14 p, 15 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 987, No 3, p 682, October 16, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Biological treatment, Oxygination, Dissolved oxygen, Activated sludge, Pressure, Equipment.

An activated sludge sewage treatment process includes a mixed liquor tank and a pressure vessel much smaller in size. All or a portion of the sewage influent to the mixed liquor tank is brought into the pressure vessel where oxygen is dissolved in the influent under pressures well above atmospheric. Then the influent is dropped to atmospheric pressure and directed into the mixed liquor tank in a gentle manner so that virtually all of the dissolved oxygen will remain under supersaturated conditions. This influent is then diluted with the material in the mixed liquor tank where the conventional sewage digestion process takes place under atmospheric conditions. It is critical to the process that the supersaturated solution be blended into the mixed liquor tank with a minimum of turbulence so that oxygen is not lost through ebullition prior to the mixing. (Sinha-OEIS)
W80-02644

METHOD FOR CONTINUOUSLY SEPARATING EMULSIONS,
Shell Oil Co., Houston, TX. (Assignee).
A. M. Benson, J. E. Heath, and M. A. Matovich.
U.S. Patent No 4,171,264, 4 p, 1 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 987, No 3, p 683, October 16, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oily water, Industrial wastes, Oil wastes, Separation techniques, Emulsions, Cellulose, Ballast water, Refinery effluents.

A method and an apparatus is described for continuously separating disperse phase and a continuous phase from a liquid-liquid emulsion. The emulsion, such as an oil-water emulsion, is flowed into a contacting zone in which the emulsion is agitated with continuous phase wet, disperse phase coalescing, length-classified chemically-pulped cellulose fibers and separated into a disperse phase and a continouus phase which are separately withdrawn. (Sinha-OEIS)
W80-02645

SUPPRESSION OF POLLUTION IN MINERAL FIBER MANUFACTURE,
Saint-Gobain Industries, Neuilly-sur-Seine (France). (Assignee).
J. A. Battigelli, and M-P. Barthe.
U.S. Patent No 4,171,265, 35 p, 18 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 987, No 3, p 683, October 16, 1979.

Descriptors: *Patents, *Waste water treatment, *Pollution abatement, *Water pollution control, Heat, Pressure, Resins, Gases, Conservation, Water reuse, Recycling, Fiber glass manufacturing.

A process, and the devices for implementing it, assures the suppression of harmful factors and permits the elimination of at least the majority of the ecologically objectionable pollutant elements contained in the gas or liquid wastes discarded by the manufacture of mineral fibers. The installation is for the manufacturing of fiber blanket, mat padding, or boards of mineral fibers and especially glass, agglomerated by thermosetting or thermoplastic binders, which coat the fibers and/or bring about close binding between fibers in the finished product. The invention is particularly concerned with recycling the majority of the fumes in the installation, and with treating and evacuating only a small portion of the fumes. Another object of the invention is to render insoluble the thermohardenable resins contained in the water. These resins are rendered insoluble by means of a heat treatment--preferably at a temperature greater than 100C, and under pressure. The application of this process is used to render insoluble the dissolved binder components contained in the water in order to subsequently be able to extract insoluble materials and thus to maintain the concentrations of the pollutants in the washing and cooling waters at a level compatible with the continuous re-utilization of these waters. The wash water thus circulates in a closed circuit and external rejection of pollutants with the wash water is eliminated. (Sinha - OEIS)
W80-02646

RECOVERY OF CALCIUM FLUORIDE FROM PHOSPHATE OPERATION WASTE WATER,
Occidental Chemical Co., Houston, TX. (Assignee).
R. J. Hirko, and H. E. Mills.
U.S. Patent No 4,171,342, 12 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 987, No 3, p 705, October 16, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Chemical wastes, *Separation techniques, Phosphates, Chemical precipitation, Water reuse, Fluorides, Product recovery.

The invention is directd to a method for recovering fluorine and phosphate values from waste waters or pond waters resluting from the production of wet process phosphorc acid. It also provides a method of neutralizing the waste waters so they can be discharged into rivers and streams without fear of pollution or recycled as process waters in the production of phosphoric acid. The pond waters are treated with calcium carbonate and/or calcium oxide to remove a substantial portion of the remaining fluorine values as calcium fluoride. After removal of the calcium fluoride the filtrate is treated with calcium oxide to remove a substantial portion of the remaining fluorine values as calcium fluoride. After removal of these calcium flouride solids, the filtrate is treated with another charge of calcium oxide to produce dicalcium phosphate (dical) which is separated from the aqueous phase. The aqueous phase is treated with an additional charge of calcium oxide to remove a substantial portion of the solids leaving water that can be discharged or recycled. (Sinha-OEIS)
W80-02647

ENDING ACID MINE WATER POLLUTION,
Ground Water Age, Vol 14, No 1, p 25, 40, November, 1979.

Descriptors: *Acid mine water, *Mine drainage, *Water pollution control, *Lime, Water pollution treatment, Coal mine wastes, Mine acids, Acidic water, Water pollution sources, Acid streams, Soil filters, Lagoons.

A new technique to control pollution of water supplies due to acid mine drainage from abandoned deep coal mines is proposed. The acid mine water is diverted to a storage lagoon below the mine an is periodically allowed to flow through an area of limed soils. The water loses its acidity as it percolates through the soil. Advantages of this technique are low operating costs, no flooding problems, and

it can be used indefinitely by periodically adding lime to the soil. (Purdin-NWWA)
W80-02658

5E. Ultimate Disposal Of Wastes

THE FARMING OF DOVER SOLE AND TURBOT IN WARMED WATERS: THE WORK OF THE BRITISH WHITE FISH AUTHORITY IN 1976, 1977 AND 1978,
White Fish Authority, Ayrshire (England).
B. P. Thain.
In: Power Plant Waste Heat Utilization in Aquaculture. B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian, C. R. Guerra and C. A. Stephens, Editors, Allanhald and Osmun & Co., Montclair, p 97-107, 1979. 1 Fig, 4 Tab, 5 Ref.

Descriptors: *Fish farming, *Growth rates, *Aquiculture, Commercial fish, Fish management, Growth stages, Fish diets, Mortality, Spawning, Productivity, Fish hatcheries, Fish behavior, *Sole, *Turbot, *Solea, *Scophthalmus.

In 1976 the White Fish Authority completed a detailed economic forecast of the commercial costs of farming Dover sole (Solea solea) and turbot (Scophthalmus maximus). Subject to certain technical progress being achieved, this forecast concluded that both these species could be produced by farming methods at less than the market value of their wild counterparts. Until the 1977 season, juvenile production of Dover sole had been disappointing, although early-stage hatchery survivals (up to day 90) had been good. During 1977 considerable advancements were made, both in weaning the fish and in the amount of both live and inert diets ingested, with the result that, at an age of 350 days, some 150 kg of live juveniles, averaging 20g, were thriving and growing well at lower water flow rates than previously achieved. Manipulation of the environment led to an advancement in spawning of the sole by 54 days in 1977 and by 107 days in 1978. Hatchery and juvenile work with turbot, reported in December 1976, have been consolidated in 1977. Intensive feeding of young turbot in round tanks with good flow distribution demonstrated an increase in growth rate of 80% over previously recorded rates with fish held in rectangular tanks having relatively poor flow patterns. (Deal-EIS)
W80-02431

AN ANALYSIS OF FEEDING RELATIONSHIPS AMONG ESTUARINE FISHES RAISED IN POLYCULTURE IN PONDS RECEIVING THERMAL EFFLUENTS,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 5A.
W80-02433

ECONOMIC EVALUATION OF THE USE OF THERMAL EFFLUENT IN LOBSTER CULTURE,
California Univ., Bodega Bay. Bodega Marine Lab.
L. W. Botsford, J. C. Van Olst, J. M. Carlberg, and T. W. Gossard.
In: Power Plant Waste Heat Utilization in Aquaculture, B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian, C. R. Guerra and C. A. Stephens, Editors, Allanhald and Osmun and Co., Montclair, New Jersey, p 79-95, 1979. 5 Fig, 1 Tab, 29 Ref.

Descriptors: *Aquiculture, *Lobsters, *Thermal pollution, Powerplants, Heated water, Cooling water, Water temperature, Growth rates, Mortality, Animal metabolism, Cost analysis, Mathematical models, Commercial shellfish.

Determination of the advisability of using thermal effluent in aquaculture depends on extensive economic evaluation. In this paper we describe some of the considerations involved in that evaluation--those dealing with production costs. A mathematical model that describes the biological performance of the lobster in culture, the culture system, and costs of system components is used to project culture costs for various operating configurations that involve the use of thermal effluent. Alternative configurations include direct and indirect use of thermal effluent, heat recovery, water recirculation, and varying culture temperature. The method that provides the least cost of operation is determined for each of several ambient temperature regimes. Direct use of thermal effluent provides lower production costs than indirect for all temperature regimes. Indirect use of thermal effluent can lower culture costs in areas of moderate ambient temperature, but may not lower culture costs in areas of high or low ambient temperatures. (Deal-EIS)
W80-02435

BIOLOGICAL AND RADIOLOGICAL ANALYSIS OF THE POTENTIAL OF NUCLEAR POWER PLANT EFFLUENT WATERS FOR SHELLFISH CULTURE,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5A.
W80-02436

DISEASONAL WASTE HEAT AQUACULTURE: A THREE-YEAR REVIEW,
Trenton State Coll., NJ. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-02437

ON FISH CULTURE AND ON THE USE OF HEATED EFFLUENTS IN POLAND,
Instytut Rybactwa Srodladowego, Zabieniec (Poland). Pond and River Dept.
For primary bibliographic entry see Field 5A.
W80-02438

WASTE HEAT AQUACULTURE IN THE UNITED KINGDOM--A GENERAL REVIEW AND PARTICULARS OF MARINE FARM LTD., HINKLEY POINT, BRIDGWATER, SOMERSET, ENGLAND,
Marine Farm Ltd., Bridgewater (England).
For primary bibliographic entry see Field 5A.
W80-02439

OVERVIEW OF ONGOING SEA GRANT PROJECTS IN THE UNITED STATES UTILIZING HEATED WATER EFFLUENTS AND ITS FUTURE POTENTIAL,
National Oceanic and Atmospheric Administration, Rockville, MD. Office of Sea Grant.
W. N. Shaw.
In: Power Plant Waste Heat Utilization in Aquaculture. B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian, C. R. Guerra and C. A. Stephens, Editors, Allanhald and Osmun and Co., Montclair, New Jersey, p 243-246, 1979. 1 Tab, 10 Ref.

Descriptors: *Thermal pollution, *Aquiculture, *Research and development, Heated water, Water temperature, Powerplants, Fish farming, Shellfish farming, Salmon, Eels, Catfishes, Trout, Oysters, Clams, Shrimp, Lobsters, Productivity, Cost analysis, Fish hatcheries.

Presently, heated water effluents are being utilized in the United States to grow a variety of organisms: salmon, Macrobrachium, eels, catfish, trout, oysters, clams, shrimp, lobsters, etc. In almost all instances, this is being done at a research level of development as in Sea Grant's research in marine shrimp and lobsters. Commercial adaptation has been limited mainly to shellfish hatcheries. The future use of heated effluent will depend heavily on the results of present, on-going research. These results should lead to a pilot test operation and eventually, if the pilot operation appears commercially feasible, to a full-fledged commercial operation. It is the author's belief that heated water can play an important role in aquaculture, but may have to be limited to the hatchery aspects. (Deal-EIS)
W80-02440

DIRECT USE OF COOLING AND BLOWDOWN WATER FOR INTENSIVE FISH FARMING RESULTS OBTAINED IN A PILOT FACILITY AT THE NIEDERAUSSEM POWER PLANT,
Rheinisch-Westfaelishches Elektrizitaetswerk A.G., Essen (Germany, F.R.). Abt Anwendungstechnik.
For primary bibliographic entry see Field 5A.
W80-02441

JAPANESE AQUACULTURE WITH THERMAL WATER FROM POWER PLANTS--PRESENT CONDITION AND PROBLEMS,
Thermal Aquaculture Development Society of Japan, Tokyo.
T. Kuroda.
In: Power Plant Waste Heat Utilization in Aquaculture. B. L. Godfriaux, A. F. Eble, A. Farmanfarmaian, C. R. Guerra and C. A. Stephens, Editors, Allanhald and Osmun and Co., Montclair, New Jersey, p 247-259, 1979. 7 Fig, 1 Tab.

Descriptors: *Aquiculture, *Powerplants, *Thermal pollution, Nuclear powerplants, Thermal powerplants, Heated water, Cooling water, Water temperature, Sea water, Commercial fishing, Commercial fish, Commercial shellfish, Fish farming, Shellfish farming, Productivity, Cost analysis, *Japan.

An increasing number of conventional-type and nuclear power plants have been completed in Japan over recent years, the types which now account for about 75% of the country's electricity production. As energy demand grows year by year, more power generating units are planned to be built. Thermal and nuclear power plants both consume large quantities of cooling water for their condensers of steam. In consideration of Japan's geographical conditions, most of these installations use seawater for cooling and are therefore located in coastal areas. They release into the sea the heated seawater. Japan depends heavily on the fishing industry, and a large percentage of the Japanese population lives on offshore fishing in all coastal areas. Used water as released has a temperature 7 to 9C higher than the natural sea temperature. This appreciably affects marine life where thermal water is discharged. The range and degree of this effect varies largely from place to place, and studies are being done at various places concerned. Research work is also in progress to find ways to avoid wasting the thermal water and somehow to utilize its heat. So far, fairly satisfactory results have been obtained in aquaculture. The following is a report on the present state and problems in application. (Deal-EIS)
W80-02442

5F. Water Treatment and Quality Alteration

JET INJECTIONS FOR OPTIMUM MIXING IN PIPE FLOW,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
S. D. Fitzgerald, and E. R. Holley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-128960, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois Research Report No 144, December 1979. 89 p, 30 Fig, 3 Tab, 12 Ref, Append. OWRT A-091-ILL (1).

Descriptors: *Mixing, *Diffusion, Jets, *Pipe flow, Water treatment, Discharge measurement, Mixing method, Mixing rates.

In order to mix an additive or a tracer with the fluid flowing in a pipe, it may be desirable to avoid the energy required and the possible maintenance problems for mixers or obstructions in a pipe and to avoid the relatively long flow length required for ambient mixing. Then, it may be advantageous to inject the additive as a jet into the pipe flow and to use the associated jet mixing to enhance the overall mixing process. Laboratory experiments were conducted to determine the rates of mixing with a single jet injection made at the pipe wall at various angles relative to the pipe wall and with

two diametrically opposed jets. For uniform pipe flow, it was possible to identify an optimum momentum for each angle of injection. A few experiments with induced swirl in the pipe flow showed that the swirl had a significant effect on the jet mixing, especially when two jets were used.
W80-02470

ELECTROLYTIC CELL FOR TREATMENT OF WATER SOLUTIONS,
Firma Hans Einhell G.m.b.H. Industriegelande, Landau (Germany, F.R.). (Assignee).
F. Stummer, and J. Miller.
U.S. Patent No 4,169,035, 6 p, 4 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 986, No 4, p 939, September 25, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Electrolysis, Electrodes, Cathodes, Scaling.

The invention is an electrolytic cell for the treatment of aqueous solutions and consists of a closed container with an inlet and an outlet for the water flowing through the container, and has at least two electrodes which can be connected to the positive and negative poles of a direct current source. The electrolytic cell is characterized in that at least one electrode constitutes an electrical conductive body which can in itself be elastically deformed, preferably by bending and/or torsion. The result of these elastic deformations of the electrode, particularly of the cathode, is that the electrode or cathode is constantly flexion and torsion stressed so that in this way the formation of undesired deposits on the electrode or cathode is prevented. (Sinha-OEIS)
W80-02621

RESIN ADSORBENT TAKES ON CHLORORGANICS FROM WELL WATER,
Rohm and Haas Co., Spring House, PA. Research Div. Labs.
E. G. Isacoff, and J. A. Bittner.
Water & Sewage Works, Vol 126, No 8, p 41-42, August, 1979. 2 Fig, 6 Tab, 9 Ref.

Descriptors: *Adsorption, *Organic compounds, *Water wells, Activated carbon, Resins, Trichloroethane, Water treatment.

Gas chromatography was used to test the effectiveness of various adsorbents in removing trichloroethane from well water. A carbonaceous resin with a chemical composition intermediate between a polymeric adsorbent and activated carbon was found to be an excellent adsorbent. This resin, having a hydrophobic surface, is designed to remove low-molecular-weight, non-polar organics or halogenated organics from aqueous or gaseous streams. It can be regenerated in sites with stream or alcohol. The resin has greater physical strength and better regenerative flexibility than activated carbon and poliymeric adsorbents. (Purdin-NWWA)
W80-02654

5G. Water Quality Control

PARAMETER IDENTIFICATION OF TWO-DIMENSIONAL ESTUARINE MODEL,
California Univ., Los Angeles. Dept. of Engineering and Applied Science.
Wen-Sen Chu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127608, Price codes: A07 in paper copy, A01 in microfiche. PhD Dissertation, 1979, 113 p, 26 Fig, 7 Tab. (California Water Resources Center Project UCAL-WRC-W-530). OWRT B-191-CAL(1).

Descriptors: *Parametric hydrology, *Mathematical models, *Model studies, *Estuaries, Linear programming, Algorithms, Water quality, Salinity, Suisun Bay(CA).

Parameter identification in a two-dimensional vertically averaged estuarine model is studied. The unknown parameters which are optimally identified are the bottom roughness coefficient and the dispersion constants. A tidally averaged model is proposed as the forward solution scheme. The tidally averaged model is solved by an implicit-explicit iterative finite difference method. Error function method and linear programming are used in the identification algorithm. Both the forward solution scheme and the identification algorithm are first tested on a carefully designed hypothetical estuary. Suisun Bay in California is then selected for practical applications. Data are collected from the San Francisco Bay-Delta Hydraulic Model for the Suisun Bay study. Roughness coefficient and dispersion constants are successfully identified by the proposed methodologies. The results indicate that the general algorithm can be applied in other existing estuaries for both well-mixed and stratified conditions. Numerical results are given in detail. Discussion of this study and recommendations for future applications are also presented. (Snyder-Cal)
W80-02409

INTERNALIZING EXTERNALITIES OF PHOSPHORUS DISCHARGES FROM CROP PRODUCTION TO SURFACE WATER: EFFLUENT TAXES VERSUS UNIFORM REDUCTIONS,
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 6B.
W80-02458

PROCESS FOR CHEMICAL DECONTAMINATION OF LAYERS OF EARTH AND/OR WATER CONTAMINATED WITH ORGANIC MATERIALS,
Aquatechnique Sierre S. A., Chippis (Switzerland) (Assignee).
E. Forte, and H. Schulthess.
U.S. Patent No 4,167,973, 6 p, 2 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 986, No 3, p 584, September 18, 1979.

Descriptors: *Patents, *Water quality control, *Organic wastes, *Water pollution, *Soil contamination, Soil treatment, Water treatment, Oxidation, Chemical reactions, Bacteriacides, Application equipment, Application methods.

There is provided an apparatus for the chemical decontamination of layers of earth and/or water contaminated with organic materials comprising the following block units: a device for withdrawal of water from a water pressure line which water is to be treated and returned into the layers of earth; a mixing device for the preparation of a mixture of water and at least one strong, chemical oxidizing agent and/or bactericide; a degassing device for removal of excess gas from the mixture; a distribution device for distributing the mixture to several feed lines; and several mobile sprinkling and/or feeding lines with drain pipes to feed the aqueous mixture to and/or the layers of earth whereby the drain pipes are at most lowered to the still water level in the water bearing layers of ground. There is also described a method of using the apparatus. (Sinha - OEIS)
W80-02612

SYNERGISTIC COMPOSITION COMPRISING PHOSPHORYLATED ETHOXYLATED GLYCERINE AND POLYACRYLIC ACID FOR THE PREVENTION OF CACO3 SCALE IN COOLING WATER,
Nalco Chemical Co., Oak Brook, IL. (Assignee).
G. T. Farley.
U.S. Patent No 4,168,230, 4 p, 1 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 986, No 3, p 662, September 18, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, *Cooling water, Industrial water, Scaling, Hardness(Water).

When certain low molecular weight polyacrylic acid salts are combined with an organic phosphate ester, an improved composition is afforded for preventing scale in industrial cooling systems. (Sinha-OEIS)
W80-02617

ENVIRONMENTAL POLLUTION FROM HIGHWAY DEICING COMPOUNDS,
Maine Univ. at Orono.
For primary bibliographic entry see Field 5C.
W80-02657

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

PARAMETER IDENTIFICATION OF TWO-DIMENSIONAL ESTUARINE MODEL,
California Univ., Los Angeles. Dept. of Engineering and Applied Science.
For primary bibliographic entry see Field 5G.
W80-02409

HYDROLOGIC EVALUATION OF THE STORMFLOW GENERATION PROCESS ON A FORESTED WATERSHED,
Pennsylvania State Univ., University Park. School of Forest Resources.
E. S. Corbett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-129133, Price codes: A07 in paper copy, A01 in microfiche. Ph.D. Thesis, November 1979. 139 p, 22 Fig, 36 Tab, 85 Ref. OWRT B-028-PA (5), 14-31-0001-3124.

Descriptors: *Forest watersheds, *Irrigation systems, *Rainfall, *Runoff forecasting, Soil moisture, Soil profiles, Analysis, Field capacity, *Hydrographs, Saturation, *Stream gages, *Hydrologic evaluation, *Stormflow generation process, Macropores, Experimental site, Quickflow, Delayed flow, Linear correlation coefficients.

In investigating the hydrologic behavior and response of a small forested watershed, an irrigation system was designed to apply a uniform amount of simulated rainfall to parts or all of a 19.59 acre experimental watershed in central Pennsylvania. To delineate the stormflow contributing areas and to evaluate their relative efficiency in converting rainfall into stormflow, a series of simulated rainfall applications were made, starting with the channel area and progressively increasing the application areas up the side slopes. The applications were made at both dry and wet antecedent soil moisture conditions and at three primary application amounts, 0.96, 1.50, and 1.92 inches. All rainfall applications were made at the rate of 0.24 inches per hour. There was a rapid reduction in the efficiency with which rainfall was converted to stormflow as distance from the perennial stream channel increased under dry antecedent soil moisture conditions. Under wet antecedent soil moisture conditions, the watershed contributed to stormflow in a more uniform manner and the stormflow components became highly correlated with storm amount. There was a large increase in the efficiency with which the middle and upper slope soil zones converted rainfall into quickflow as positive hydraulic gradients became established in these areas of the watershed. The percent of rainfall converted into quickflow ranged from 1.6 to 75.8 percent over the measured range of soil moisture conditions. (Tsong-Pennsylvania)
W80-02474

THE YAMPA RIVER BASIN, COLORADO AND WYOMING--A PREVIEW TO EXPANDED COAL-RESOURCE DEVELOPMENT AND ITS IMPACTS ON REGIONAL WATER RESOURCES,
Geological Survey, Lakewood, CO. Water Resources Div.
T. D. Steele, D. P. Bauer, D. A. Wentz, and J. W. Warner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 815, Price codes: A07 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-126, September 1979. 133 p, 35 Fig, 16 Tab, 124 Ref.

Descriptors: *Environmental effects, *Mining, *Coal mine wastes, *Water resources, *Water

quality, Regional analysis, Colorado, Wyoming, River basins, Water supply, Water rights, Water demand, Water pollution control, Surface waters, Groundwater, Land use, Public lands, Planning, Evaluation, *Yampa River basin(Colo-Wyo), Residuals management.

Expanded coal production and conversion in the Yampa River basin, Colorado and Wyoming, may have substantial impacts on water resources, environmental amenities, and socioeconomic conditions. Preliminary results of a 3-year basin assessment by the U.S. Geological Survey are given for evaluation of surface- and ground-water resources using available data, modeling analysis of waste-load capacity of a Yampa River reach affected by municipal wastewater-treatment plant effluents, and semiquantitative descriptions of ambient air- and water-quality conditions. Aspects discussed are possible constraints on proposed development due to basin compacts and laws regulating water resources, possible changes in environmental-control regulations, and policies on energy-resource leasing and land use that will influence regional economic development. (Woodard-USGS)
W80-02582

FLOW ROUTING IN THE SUSQUEHANNA RIVER BASIN: PART III - ROUTING RESERVOIR RELEASES IN THE TIOGA AND CHEMUNG RIVERS SYSTEM, PENNSYLVANIA AND NEW YORK,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. T. Armbruster.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 393, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-85, July 1979. 34 p, 12 Fig, 6 Tab, 15 Ref.

Descriptors: *Model studies, *Reservoir releases, *Streamflow, *Routing, *Low-flow augmentation, Simulation analysis, Planning, Pre-impoundment, Evaluation, Regulated flow, Analytical techniques, Drainage area, New York, Pennsylvania, *Susquehanna River Basin Commission, *Tioga and Chemung Rivers System (PA-NY).

Channel-routing models were used to route hypothetical releases from reservoirs in the upper Tioga River basin, Pennsylvania. These releases were routed northward down the Tioga River to Lindley, Erwins, and Corning, New York: combined with flows routed down the Cohocton River from Campbell to Corning, New York; and then routed southeastward down the Chemung River from Corning to Chemung, New York. The models used to route the flows of Cohocton and Chemung Rivers accounted for bank-storage discharge and streamflow depletion by well pumpage. In general, 17 water years of concurrent streamflow data were available for model calibration and verification. Three hypothetical reservoir releases were made from the reservoirs and routed to Wilkes-Barre, Pennsylvania, using the models developed in this study and models developed downstream to Wilkes-Barre in a previous study. A hypothetical makeup water requirement of 65 cubic feet per second was assumed. Two historical low-flow periods were investigated. The first hypothetical release investigated was a constant 100 cubic feet per second, and the second release was a constant 70 cubic feet per second. The third scheme was a hypothetical release of 100 cubic feet per second for three days followed by a constant 70 cubic feet per second for the duration of the period considered. Constant 100 cubic feet per second releases arrived downstream more quickly than constant 70 cubic feet per second releases for both test periods, but delivered more water than required to satisfy the assumed makeup requirement. The third release scheme was generally the most efficient of the three schemes tested. (Woodard-USGS)
W80-02586

A PROBABILISTIC OPTIMIZATION MODEL FOR WATER RESOURCES CAPACITY EXPANSION WITH PRICE-SENSITIVE SEASONAL DEMAND,
California Univ., Los Angeles. School of Engineering and Applied Science.
B. Nieh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-139553, Prices codes: A10 in paper copy, A01 in microfiche. Ph. D. Dissertation, 1979. 179 p, 26 Fig, 23 Tab, 5 Append. (California Water Resources CTR Proj UCAL-WRC-W-518). OWRT-A-062-CAL(3).

Descriptors: *Optimization, *Computer model, *Mathematical models, *Probability, Size, Time, Investment, Reservoirs, Water conveyance, Desalination plants, Economics, Operating costs, Financial analysis.

This study presents the development and application of a mathematical programming model for planning regional water resources capacity expansion when seasonal demands are price dependent and inflows are stochastic. This multi-planning period model simultaneously considers the investment and allocation (pricing) decisions associated with the present and future water resources development. The procedure consists of selecting the sizing, sequencing and timing of investment in surface reservoirs, water conveyance facilities, seawater desalting plants that maximizes the present worth of the total expected benefits (consumers' willingness-to-pay) less investment costs, operating costs and future debts. Groundwater storage is considered an integral part of this selection. Instream quantity requirements for quality control and a revenue constraint that requires the total discounted revenues must cover the total discounted costs are explicitly considered in this optimization model. Long-run seasonal price-sensitive bulk water demand is a key variable in this investment planning model. It serves both as an indicator of water value and as a feedback signal to consumers, reflecting the cost of investments required to satisfy particular demand. The mathematical programming model that if formulated is large scale and has both binary and linear constraints. A mixed integer linear programming code based on a branch-and-bound algorithm is used to obtain solutions to the model. (Snyder - Cal)
W80-02606

AN IMPROVED MONTE CARLO PROCEDURE FOR THE SOLUTION OF THE STEADY-STATE, TWO-DIMENSIONAL DIFFUSION EQUATION WITH APPLICATION TO FLOW THROUGH POROUS MEDIA,
Kansas Univ., Lawrence. Dept. of Mechanical Engineering.
J. H. Turner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-132616, Price codes: A09 in paper copy, A01 in microfiche. M Sc Thesis, (1979), 191 p, 18, 7 Append, OWRT B-045-KAN (2) 14-34-0001-6079.

Descriptors: *Floating random walk, *Monte Carlo method, *Diffusion, Porous media, *Diffusion equation, Heat conduction, Evaluation.

Monte Carlo procedures for solving the diffusion equation of heat conduction and flow through porous media have been known for some years. Various investigators have indicated that the so-called floating random walk Monte Carlo procedure offers advantages in terms of computer execution time for single point solutions and complex geometries over finite difference procedures. This work investigates an improvement to the floating random walk. The improvement is based upon the use of exact analytical solutions to the diffusion equation interpreted in probabilistic form. A comparison is made for a number of test cases between what is referred to as a conventional Monte Carlo procedure and the improved Monte Carlo procedure. In addition, a comparison is made to an ADI finite difference procedure. The results indicate that the improved Monte Carlo procedure is more efficient than the conventional Monte Carlo procedure in terms of computer execution time and is competitive with, and may even be superior to, the ADI finite difference procedure in some cases.
W80-02607

6B. Evaluation Process

MARINE RESOURCES: THE ECONOMICS OF US OCEAN POLICY,
Washington Univ., Seattle.
J. A. Crutchfield.
American Economic Review, Vol 69, No 2, p 266-271, 1979.

Descriptors: *Marine resources, *Economics, *Water resources development, *International waters, *Oceans, Sea water, Desalination, Manganese nodules, Marine fisheries, Oil, Mineral industry, Surveys, Salts, Natural gas, Energy, Costs, Benefits, Dredging.

Present and potential prospects for marine resources development are discussed within the framework of the supply and demand on these resources from all sources. It is concluded that the present value of most mineral resources is near zero. Their significance is in the ceiling they impose on future increases in prices for the same minerals from land sources. Power from tidal sources or temperature gradients, desalination of sea or brackish water for human consumption, and exploitation of hard rock minerals, dissolved minerals such as sand and gravel, phosphorite and ferro-manganese nodules are placed in this category. Currently, unconsolidated minerals offer the most important prospect. Annual production of sand and gravel by inshore dredging is estimated at about $80 million for 1976. Copper, nickel, cobalt and manganese in ferro-manganese nodules are potentially important since they are metals imported by the U.S., but capital requirements are high and legal title uncertain. Offshore petroleum and natural gas is valuable, being produced along the coasts of some 50 nations, but it is not necessarily in the interest of the U.S. of the world community to rush its production. World production of fish has risen from 20 million metric tons in 1946 to 70 million in 1970. However, most of the increase has been in industrial production for meal and oil; there has been no increase for direct human consumption. Utilization and management of this living resource of the sea has been poor, with constant pressure toward depletion or destruction of the fishery, and the use of more gear and labor than is required for its harvest (Luedtke-Wisconsin)
W80-02449

THE ECONOMICS OF MARINE FISHERIES MANAGEMENT IN THE ERA OF EXTENDED JURISDICTION: THE CANADIAN PERSPECTIVE.
Simon Fraser Univ., Burnaby (British Columbia).
For primary bibliographic entry see Field 6E.
W80-02450

POSSIBLE DEVELOPMENTS IN U.S. AND GLOBAL FISH MARKETS DUE TO EXTENDED JURISDICATION AND A PROPOSED RESEARCH AGENDA,
Synergy, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-02451

A MACROECONOMIC ANALYSIS OF REGIONAL ENVIRONMENTAL MODELING AND PLANNING,
Wyoming Univ., Laramie. Dept. of Economics.
D. S. Brookshire.
Journal of Environmental Economics and Management, Vol 5, No 3, p 268-281, 1978. 4 Tab, 17 Ref, 2 Append.

Descriptors: *Regional analysis, *Economic efficiency, *Model studies, *Environmental quality, *Pollution abatement, Southwest US, Regional economics, Investment, Disamenities, Multipliers, Trade model, Economics.

An approach to environmental quality control in the framework of two interregional trade models is presented. Alterations in the institutional structure of a region through exogenous investments are shown as a tool for regional adjustments in envi-

ronmental quality. An expanded Metzler interregional model which incorporated regional disamenities into the multiplier structure is demonstrated, along with a regional migration model for estimating regional disamenities; the latter model suggests that a concept of aggregate efficiency should be established for allocating large exogenous investment expenditures across regions. An example of the approach uses data for the Southwestern U.S. Revised regional multipliers which include disamenities levels are calculated and investment decisions are considered with and without disamenity effects. The example suggests that failure to include disamenity corrections in regional multipliers will lead to greater regional inequality in welfare. Rankings of states varies considerably between the corrected and uncorrected cases. A major shortcoming of the approach is that it does not differentiate rural versus nonrural considerations. (Luedtke-Wisconsin)
W80-02452

PUBLICLY VESTED VALUES FOR FISH AND WILDLIFE: CRITERIA IN ECONOMIC WELFARE AND INTERFACE WITH THE LAW,
Fish and Wildlife Service, Sacramento, CA. Water Policy Center.
P. A. Meyer.
Land Economics, Vol 55, No 2, p 223-235, May 1979. 1 Tab, 36 Ref.

Descriptors: *Market value, *Wildlife, *Fish, *Willingness to pay, *Compensation, Welfare economics, Theoretical analysis, Evaluation, Legal aspects, Economics, Recreation.

The economic basis for estimating fish and game values is reviewed and compared with current recreational area use. Welfare economics distinguishes between the amount owners are willing to pay for the resource and the compensation required by those who lose it when public fish and game resources are destroyed. It is commonly presumed that the value difference between willingness to pay and demand for compensation is not great. This study suggests that willingness to pay does not differ from need to be compensated only for relatively small environmental products. Display of all compensatory demands on an offer curve (a schedule of the number of respondents willing to sell their rights to the public good being studied at each of a series of possible prices) allows all data to be considered, overcoming shortcomings of a single number estimate which frequently excludes from the cost benefit analysis those least willing to experience environmental loss. Also examined is the interface between legal and economic principles as it affects the evaluation of fish and game losses. Conclusions: (1) Proper evaluation practices may be supported by law where gains and losses are distributed between differing jurisdictional groups. (2) Principles of public trust or police powers may provide a basis for calculation of compensatory damages. (3) Where legislators, the courts or administrators attempt to go beyond ordinary regulatory process to deal with public welfare, economic principle requires that the compensatory needs of those experiencing losses be considered. (Luedtke-Wisconsin)
W80-02454

RECLAMATION POLICY AND THE WATER SUBSIDY, AN ANALYSIS OF THE DISTRIBUTIONAL CONSEQUENCES OF EMERGING POLICY CHOICES,
California Univ., Davis. Dept. of Agricultural and Resource Economics.
E. P. LeVeen, and G. E. Goldman.
American Journal of Agricultural Economics, Vol 60, No 5, p 929-934, December 1978. 1 Tab, 10 Ref.

Descriptors: *Federal Reclamation Law, *Costs, *Benefits, *Irrigation programs, *Water subsidy, Rural development, Family farms, Irrigation, Income distribution, Westlands, Water users, Cost repayment, Water costs, Social aspects.

The magnitude and inequality of distribution of water subsidy in Reclamation Act irrigation projects is examined with respect to current administration of the law and to proposed changes. Originally very little subsidy was included in the Reclamation program, with users required to repay full project cost less interest within 10 years. However, due to an extension of the repayment period to 40 years, use of hydroelectric power revenues to offset some irrigation costs, effects of inflation, and an additional subsidy resulting from a much lower power rate charged for pumping irrigation water, water users now pay only a small fraction of all irrigation costs. Requiring users to repay full costs would raise fees an average of 17 times present levels. While irrigation projects increase the productivity and economic value of private lands, there is no clear relationship between this increased value and the public costs of a project. In addition, original land owners received most of the windfall projects benefits, averaging $1.45 million per-owner of excess land in the Westlands example, and very few new farms were created. Of proposed changes in the administration of the law, only strict enforcement of the existing laws would provide a substantially wider distribution of subsidy benefits. In the Westlands case, the imposition of these requirements would create only 1400 new farms at a public expenditure of one billion dollars. Benefits would still be over $20,000/yr in addition to the usual return. It is concluded that alternative policies be explored to more effectively promote family farming and rural development. (Luedtke-Wisconsin)
W80-02455

INTERNALIZING EXTERNALITIES OF PHOSPHORUS DISCHARGES FROM CROP PRODUCTION TO SURFACE WATER: EFFLUENT TAXES VERSUS UNIFORM REDUCTIONS,
Wyoming Univ., Laramie.
J. J. Jacobs, and G. L. Casler.
American Journal of Agricultural Economics, Vol 61, No 2, p 309-312, May 1979. 1 Fig, 2 Tab, 12 Ref.

Descriptors: *Phosphorus, *Efficient tax policy, *Economic efficiency, *Farm management, *Uniform reduction policy, *Social aspects, *Pollution taxes(charges), Fall Creek(NY), Lake Cayuga(NY), New York, Soil erosion, Surface runoff, Crop production, Linear programming, Total costs, Costs, Effluents, Political constraints.

Social costs and costs of farmers of achieving given levels of phosphorus discharge reduction from crop production for effluent taxes are empirically compared to a uniform reduction policy in the Fall Creek watershed, New York. The cost of reducing phosphorus discharges due to surface runoff and soil erosion by 10% to 60% was estimated with a linear programming model of the agricultural production sector of the watershed. Results indicate that the effluent tax policy allows each level of phosphorus discharge reduction to be achieved more efficiently than the uniform reduction policy in terms of social cost to socity. However, the total cost to the farmer is much greater for the tax policy than for the uniform reductions policy. The required effluent tax when added to the reduction in income, makes the total cost to the farmer 2.7 to 13.3 times higher, which may not make the effluent tax policy politically feasible or equitable. An alternative effluent tax policy is proposed which would preserve the lower social costs benefits of an effluent tax and yet not be so charged on the desired level of discharge. This would allow economically efficient achievement of discharge goals and keep the total cost to the farmer as low or lower than that of the uniform reduction policy. (Luedtke-Wisconsin)
W80-02458

1977 MARKET FOR WATER AND WASTEWATER TREATMENT EQUIPMENT,
Bureau of Domestic Business Development, Washington, DC. Office of Business Policy Analysis.
K. L. Kollar, and J. Matticks.
Journal of the Water Pollution Control Federation, Vol 51, No 4, p 672-688, 1979. 1 Fig, 13 Tab, 1 Append.

Descriptors: *Marketing, *Industrial production, *Equipment, *Waste water treatment, *Sales, Municipal water, Industrial water, Municipal wastes, Industrial wastes, Market value, Surveys, Utilities, Treatment facilities, Costs, Industrial plants, Effluents, Recirculated water, Construction.

A survey of water and wastewater treatment equipment manufacturers was conducted in 1977 by the U.S. Department of Commerce for industrial mobilization planning purposes to update similar surveys completed in 1965, 1968, 1970. This report summarizes and compares data from the 1970 and 1979 surveys, disaggregating the market by municipal water supply, industrial wastewater treatment, and municipal wastewater treatment. The surveys are based on manufacturers' responses to a questionnaire on manufacturing plant production capacity and value of equipment shipments. Municipalities and industry spent more than $820 million for water and wastewater treatment equipment in 1977, an increase of $472 million over that spent in 1970. Nearly two-thirds, $536 million, was spent on wastewater treatment equipment ($355 million by municipalities and $181 million by industry), while $285 million was for water treatment equipment ($123 million by municipalities and $162 million by industry). This represents a nearly 135% increase in total equipment sales since 1970. While both water and wastewater equipment markets grew significantly between 1970 and 1977, the growth in wastewater equipments sales was nearly three times that for water treatment equipment sales. This market is dominated by relatively few firms, with 50 plants reporting more than 75% of total shipments. Twenty-three major categories of equipment are reported. Production capacity of the industry averaged about one-half of potential manufacturing capacity. (Luedtke-Wisconsin)
W80-02460

THE GROUND-WATER GEOTHERMAL HEAT PUMP: AN IDEA WHOSE TIME HAS COME,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 8C.
W80-02649

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

RECLAMATION POLICY AND THE WATER SUBSIDY, AN ANALYSIS OF THE DISTRIBUTIONAL CONSEQUENCES OF EMERGING POLICY CHOICES,
California Univ., Davis. Dept. of Agricultural and Resource Economics.
For primary bibliographic entry see Field 6B.
W80-02455

CONCEPTS OF VALUE FOR MARINE RECREATIONAL FISHING,
Illinois Univ. at Urbana-Champaign, Dept. of Forestry.
J. F. Dwyer, and M. D. Bowes.
American Journal of Agricultural Economics, Vol 60, No 5, p 1008-1012, December 1978. 22 Ref.

Descriptors: *Fishing, *Cost-benefit analysis, *Methodology, Sea water, Recreation demand, Willingness to pay, Willingness to sell, Compensation, Value, Economics, Fish management, Resources development, Costs, Benefits, Travel cost method, Survey based method, Hedonic pricing.

Cost/benefit procedures for estimating changes in marine recreational fishing benefits under various resource management options are discussed. Maximum willingness to pay is used to measure gains in benefits due to such options as an increased stock of fish, while minimum desired compensations or willingness to sell is used to measure losses. Both concepts are estimated from a demand curve for recreation at a particular area. Travel cost and survey methods are used to estimate demand for and value of marine recreational fishing. Fishing quality is affected by many resource management decisions and also must be included in the analysis. This includes fishing success rate at particular sites, number of fish caught, congestion in the fishing area, services provided by charter industries, catch

composition, size of fish caught, and weather or sea conditions. Major improvements being made in the travel cost method include better procedures for building in substitutes, quality, and traveltime, and applying the model to new types of situations. Survey methods have received less attention, but recently have been used by the U.S. Fish and Wildlife Service. A component of this, the hedonic pricing approach, provides a new approach to evaluation of changes in quality. (Luedtke-Wisconsin)
W80-02456

INTERNALIZING EXTERNALITIES OF PHOSPHORUS DISCHARGES FROM CROP PRODUCTION TO SURFACE WATER: EFFLUENT TAXES VERSUS UNIFORM REDUCTIONS,
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 6B.
W80-02458

WATER USER DEMAND: COST ALLOCATION AND TAXATION,
Montreal (Quebec).
For primary bibliographic entry see Field 6D.
W80-02459

PRICING PROBLEMS IN AN INPUT-OUTPUT APPROACH TO ENVIRONMENT PROTECTION,
Linacre Coll. Oxford, (England).
R. Lowe.
The Review of Economics and Statistics, Vol 61, No 1, p 110-117, 1979. 3 Tab, 1 Ref.

Descriptors: *Input-output analysis, *Pollution abatement, *Theoretical analysis, Standards, Pricing, Effluent taxes, Pollution taxes(Charges), Taxes, Costs, Value added taxes, Sales taxes, Linear programming, Mathematical models, Industrial production, Shadow prices.

Leontief's input-output model for pollution pricing is placed in a broader theoretical framework, using a linear programming objective to choose among production techniques and abatement activities when pollution standards are imposed. A dichotomy is revealed between the role of ordinary dual-shadow variables as economic opportunity costs and of quasi-dual variables as prices under competitive minimization. This dichotomy, which arises because untreated net pollution is discharged free to final consumers, shows that the determination of antipollution costs and their impact on industrial prices is not identical to the opportunity costs of environmental restriction in terms of extra value added to or lost final demand. Three ways of financing pollution through taxation are considered: (1) state value-added taxes, (2) final sales taxes, and (3) effluent taxes. The examples emphasize that quasi-dual variables provide the correct financial basis for balanced input-output accounts, whether concerned with private abatement or state-operated schemes financed through any of the three methods. In each case, these taxes provide sufficient revenue to eradicate pollution to a desired standard, thus enabling both taxes and standards to be contained within a common framework. (Luedtke-Wisconsin)
W80-02461

INTEGRATED PLANNING OF A METROPOLITAN WATER AND WASTEWATER SYSTEM WITH PRICE SENSITIVE WATER-WASTEWATER SERVICE DEMANDS,
California Univ., Los Angeles. Dept. of Engineering Systems.
S. K. Mozumder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-130271, Price codes: A08 in paper copy, A01 in microfiche. Ph.D. Dissertation, 1979. 154 p, 23 Fig, 33 Tab, 66 Ref, Append. (California Water Resources CTR Proj UCAL-WRC-W-518), OWRT-A-062-CAL(2).

Descriptors: *Water supply, *Water reuse, *Waste water(Pollution), *Waste water disposal, Water costs, Economics, Municipal wastes, Model studies, Computer models.

A multi-faceted water-wastewater development scheme for a metropolitan area articulated over multi-seasons and multi-time periods is presented. Water-wastewater 'development' through acquisition of more local surface and groundwater, external import, reclaimed water reuse, reallocations of consumptions among competing sectors, and conservation by invoking economic measures is considered. A deterministic approach of analyzing water-wastewater development planning, using mixed-integer programming technique, is proposed. The objective of the analytical solution is to maximize discounted value of net benefits attributable to the water-wastewater services of a metropolitan area within a specified time-horizon. Temporal decisions specifying the quantities extracted and recharged to groundwater, imported from external sources, and reused from wastewater reclamation plants to meet potable and non-potable demands are provided by the solution. Also, the results incorporate selection of efficient water-wastewater projects (timing and sizing of water-wastewater treatment, storage and distribution facilities). To demonstrate the workability of the analytical framework, an example problem based on the data made available from Santa Clara Valley Water District of Northern California was solved. (Snyder-California)
W80-02605

6D. Water Demand

WATER USER DEMAND: COST ALLOCATION AND TAXATION,
Montreal (Quebec).
S. Jack, C. Barube, and H. Demard.
Journal of American Water Works Association, Vol 71, No 4, p 194-196, 1979. 3 Tab, 6 Ref.

Descriptors: *Water demand, *Water allocation(Policy), *Water rates, *Saint Foy(Quebec), Water users, Water utilization, Costs, Taxes, Water works, Water distribution(Applied), Municipal water, Methodology, Quebec, Canada.

The impact of user demand on the design and operation of the Saint Foy, Quebec, municipal water system is analyzed. A method for allocating joint water costs to individual user groups is developed and a tax structure oriented to demand management is suggested. The water capacity needed by each used group is identified. User demand is evaluated over the following time frames: average daily, peak daily, hourly and instantaneous. Residential and commercial users are defined according to their demand characteristics which are then related to the required components of the water system. This allows system costs to be assessed to particular user groups according to the capacity required in the component to meet each groups demand. The allocation of system component capacity to its three elements, actual user demand, potential demand, and indirect demand, is accomplished by linear and marginal methods. Since costs are to be recovered according to service rendered, the replacement cost of components is an equitable basis for cost allocation. Demand management and financial yield, equity, control of urban development and the customers ability to pay are the principles upon which the proposed tax structure is based. (Luedtke-Wisconsin)
W80-02459

STUDIES ON THE INFLUENCE OF MAN (ANGLING) ON FRESHWATER FISH POPULATIONS IN SOUTHERN POLAND,
Polish Academy of Sciences, Krakow. Inst. of Biology.
For primary bibliographic entry see Field 6G.
W80-02487

EXPLOITATION OF FISHERY RESOURCES IN LAKE BALATON,
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
For primary bibliographic entry see Field 6G.
W80-02488

AVAILABILITY AND USE OF WATER IN NEBRASKA, 1975,
Geological Survey, Lincoln, NE. Water Resources Div.
R. Bentall, and F. B. Shaffer.
Nebraska Water Supply Paper Number 48, June 1979. 121 p, 27 Fig.

Descriptors: *Nebraska, *Water supply, *Available water, *Water utilization, Irrigation, Municipal water, Domestic water, Industrial water, Livestock, Electric powerplants, Hydroelectric power, Surface waters, Groundwater, Reservoirs, Lakes, Ponds, Hydrology, Evaporation, Precipitation(Atmospheric).

Water supplies available for use and the uses made of those supplies in Nebraska during the 1975 water year are evaluated. Available supplies that year consisted of holdover storage in surface reservoirs (combined capacity of principal reservoirs, 3.05 million acre-feet), lakes and ponds, groundwater storage (estimated at 1.875 billion acre-feet), canal and river inflow (1.71 million acre-feet), and precipitation (80.5 million acre-feet). Use of reservoir releases and water diverted from flowing streams plus water pumped from wells totaled 9.91 million acre-feet. An additional 6.34 million acre-feet was used for generating hydroelectric power. About 83 percent of the 9.91 million acre-feet was used for irrigation and the remaining 17 percent was used for municipal, rural domestic, and livestock supplies, for cooling at fuel-electric plants, and by industries not supplied by municipal water systems. About 72 percent of the water used for irrigation was obtained from wells. An analysis of streams discharges indicated that seepage from ground-water reservoirs accounted for about 55 percent of total streamflow in water year 1975. However, ground water constituted slightly less than half the outflow from Nebraska because overland runoff to streams is greatest in the part of the State where use of surface water is minimal and most of the outflow occurs. (Woodard-USGS)
W80-02592

6E. Water Law and Institutions

FLORIDA'S 'REASONABLE BENEFICIAL' WATER USE STANDARD: HAVE THE EAST AND WEST MET,
Florida Univ., Gainesville.
F. E. Maloney, L. C. Capehart, and R. S. Hoofman.
University of Florida Law Review, Vol 31, No 2, p 253-83, Winter 1979. OWRT B-030-FLA(2), 14-34-0001-7113.

Descriptors: *Florida, *Water permits, *Water allocation(Policy), Legislation, Judicial decisions, Beneficial use, Reasonable use, Common law, Water policy, Water rights, Consumptive use, Water law.

In 1972, a year of major environmental legislation in Florida, the legisalture made changes in the system of water management through enactment of the 1972 Florida Water Resources Act (FWRA). The FWRA is designed to provide comphrehensive and hydrologically sound state regulation of Florida's water resources. The FWRA provides for establishment of a permit program for consumptive water use. To obtain a permit, the applicant must establish that the proposed use: (1) is a reasonable beneficial use; (2) will not interfere with any presently existing legal use; and (3) is consistent with the public interest. Reasonable beneficial use is defined as the use of water in such quantity as is necessary for economic and efficient utilization for a certain purpose reasonable and consistent with the public interest. The meaning of a reasonable beneficial use is examined through analysis of the common law of both reasonable use and beneficial use. Factors develop to assist administrative agencies in establishing guidelines for determination of whether a proposed use satisfies the reasonable beneficial standard are also set forth. (Ewing-Florida)
W80-02415

THE ECONOMICS OF MARINE FISHERIES MANAGEMENT IN THE ERA OF EXTENDED JURISDICTION: THE CANADIAN PERSPECTIVE.
Simon Fraser Univ., Burnaby (British Columbia).
P. Copes.
The American Economic Review, Vol 69, No 2, p 256-260, May 1979. 9 Ref.

Descriptors: *Marine fisheries, *Fish management, *200 mile economic zone, *Evaluation, *Canada, Political aspects, Benefits, Economic efficiency, Foreign trade, Coasts, International waters, Commercial fishing, Resources development, Management, Economics, Informal Composit-Negotiating Text.

The 200-mile economic zone, as reflected by the Informal Composite Negotiating Text, is proving beneficial in regeneration of resource rents and restoring overfished coastal stocks. Distribution of resulting benefits favors coastal nations and their allocation will be affected by interzone boundary determinations and by trade diversions. Being sole owners of fish stocks allows for more rational resource management and helps extend fishing operations of coastal nations at the expense of distinct-water operations. However, the territorial definition of fisheries jurisdiction has limited the effectiveness of the new management regimes with uncertain effects on transboundary stocks and has reduced access to distant-water fleets may lead to further over-exploitation in the high seas. Canada's experience with the 200-mile limit is used to illustrate opportunities and problems of extended jurisdiction. The pressure for excessive effort in the 200 mile fishery has not changed, but Canada is now able to reserve larger stocks to accommodate that pressure. In addition, a beneficial short-run accommodation has been arranged with foreign fishing fleets to harvest stocks which Canada cannot harvest economically at this time. The potentially most serious threat is that distant water fleets, displaced from the 200 mile zone, will divert their attention to high seas salmon of North American origin and other transboundary stocks. (Luedtke-Wisconsin)
W80-02450

POSSIBLE DEVELOPMENTS IN U.S. AND GLOBAL FISH MARKETS DUE TO EXTENDED JURISDICATION AND A PROPOSED RESEARCH AGENDA,
Synergy, Inc., Washington, DC.
T. Colvin, D. Zimmerman, and B. Hinds.
Marine Technology Society Journal, Vol 13, No 2, p 18-25, 1979. 6 Tab, 7 Ref.

Descriptors: *Marine fisheries, *Fish management, *Economic prediction, *200 mile economic zone, *Regulation, Regression analysis, Commercial fishing, Econometrics, Economic impact, Forecasting, Marketing, Fish harvest, Prices, Foreign trade, Model studies.

This report presents preliminary results of a study to determine whether additional research on economic models used to analyze the extended 200-mile fishing zone is needed. Econometric forecasting models are used to develop baseline forecasts of expected occurrances in U.S. fisheries under several extremely limiting assumptions. These forecasts are used tc determine marginal impacts of new National Marine Fisheries Service initiatives and programs and allow for a zero-based budget. Results in the form of a set of simple reduced form market price functions show that real prices of most market categories increase. Four scenarios are presented for comparison. The first scenario assumes that all fish species caught off U.S. coasts by foreigners in 1974 will be caught by U.S. fishermen, in 1977 and supplied to both domestic and foreign markets; the second scenario assumes that the world supply of fish drops dramatically the third and fourth assume that landings will increase 2% and 5% each year due to successful management and rebuilding of stocks. Strange results were reported when these scenarios were analyzed. A sensitivity analysis of fish market models was run to correct the problem. Results of this show great disparities in changes of real prices for market categories. Additional research in fisheries market models is needed to: (1) obtain more realistic forecasts of what U.S. and foreign fishermen and governments are planning, and (2) refine the U.S. market supply and demand parameter estimates. (Luedtke-Wisconsin)
W80-02451

ENVIRONMENTAL FINANCING LITIGATION,
G. G. Minturn.
Natural Resources Journal, Vol 19, No 3, p 679-686, July 1979.

Descriptors: *Attorneys fees, *Litigation, *Federal Water Pollution Control Act, Citizen suits, Judicial decisions, Legal aspects, Save Our Sound Fisheries Association vs. Callaway, Natural Resources Defense Council vs Costle, Section 1365, FWPCA.

Environmental plaintiffs who use citizen-suit provisions of the Federal Water Pollution Control Act (FWPCA) may seek an award of attorneys fees provided they comply with strict jurisdictional requirements of Section 1365 of the Act. These requirements include giving 60 days notice to all parties before filing suit and confining the suit to certains violations by polluters or nondiscretionary omissions by the Administration of the Environmental Protection Agency. Meeting the requirements of Section 1365 is a major problem because they are much stricter than statutory provisions of other authorizing legislation. Even if these requirements are met, the court has wide discretion in determining who will receive an award. Defendants will not generally receive attorneys fees unless they can demonstrate they were victims of a harrassing or frivolous action. Plaintiffs must demonstrate that their action was in the public interest and that, it served the purpose intended by Congress in providing for citizen suits in the FWPCA. The cases of Save Our Sound Fisheries Association vs. Callaway and the Natural Resources Defense Council vs Costle are cited to demonstrate these criteria. (Luedtke-Wisconsin)
W80-02453

JOINT VENTURE IN FISHERIES BETWEEN DISTANT-WATER AND DEVELOPED COASTAL NATIONS: AN ECONOMIC VIEW,
Washington Univ., Seattle. Inst. of Marine Studies.
W. Kaczynski.
Ocean Management, Vol 15, No 1, p 39-48, 1979. 2 Tab, 6 Ref.

Descriptors: *Marine fisheries, *International cooperation, *Economic efficiency, *Jurisdiction, Joint ventures, International waters, 200-mile economic zone, Marketing, Fish harvest, Commercial fishing, Economics, Foreign trade, Costs, Benefits, Resources development.

Extension of national jurisdiction and a radical change in the pattern of access to the coastal fishery resources imply that international cooperation between developed coastal and foreign fishing countries offers the optimal way to exploit the resource. Joint exploitation is a way for distant-water fishing nations to partially neutralize harvesting limitations imposed on them as well as to produce additional income opportunities. With their increasing range of operations, these joint ventures also have provided land-based facilities for support services, including fish cargo handling ship repair; and crew recreational facilities. Japan currently has the most joint ventures with the U.S., supplying fish products to the Japanese consumption market. Many other distant-water fishing nations, including those in Eastern Europe, have begun to develop cooperative links with coastal nations in recent years in order to alleviate harvesting restrictions and increase employment opportunities for their fleets. Joint ventures benefit developed coastal nations by fostering exploitation of coastal resources during periods when these cannot be utilized by local fishermen. They are attractive to both sides if they produce additional volumes of fish and if they offer an economically more effective way of resource utilization. Development of lower market value species in nations such as the U.S., Canada, and Australia, offers considerable potential. (Luedtke-Wisconsin)
W80-02457

PUBLIC RECREATION ON VIRGINIA'S INLAND STREAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Virginia Water Resources Research Center.
W. E. Cox, and K. A. Argow.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-131394, Price codes: A05 in paper copy, A01 in microfiche. Bulletin 120, October 1979. 93 p, 1 Fig, 2 Tab, Append, OWRT A-073-VA(1).

Descriptors: *Recreation, *Public rights, *Water law, *Virginia, *Streams, Public access, Riparian rights, Canoeing, Fishing, Navigability, Landowners' attitudes, Property rights.

Analysis of decisions of the Virginia court concerning the public right of navigation and the ownership of lands beneath the waters of streams allows tentative conclusions to be reached regarding public recreational rights. In general, streams suitable for commercial navigation have publicly owned beds and are open to public use. The public generally has no recreational right in streams not navigable by the commercial-use test unless reserved in state ownership by 1780 and 1802 Virginia statutes. Official navigability determinations have not been made for many of the state's streams with the result that uncertainty continues to exist in many individual cases. Part I of this report examines specific declarations of public recreational rights, the navigability issue, the streambed ownership issue, and other factors affecting public rights. Part II reports a survey of riparian landowners' perceptions regarding public recreational use of streams.
W80-02604

GROUND WATER STORAGE FOR CALIFORNIA WATER PROJECT,
California State Dept. of Water Resources, Los Angeles. Southern District.
For primary bibliographic entry see Field 4B.
W80-02663

6F. Nonstructural Alternatives

FLOOD-PLAIN MANAGEMENT: ADMINISTRATIVE PROBLEMS AND PUBLIC RESPONSES,
Kansas Water Resources Research Inst., Manhattan.
E. J. Baur, and J. M. Weller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-128895, Price codes: A04 in paper copy, A01 in microfiche. Contribution No 206, June 1979. 45 p, 60 Ref, 2 Append. OWRT A-081-KAN (1), 14-34-0001-7036.

Descriptors: *Flood plain management, *Flood plain insurance, *Flood plain zoning, Public participation, Medium sized cities, Kansas, Iowa, Missouri, Nebraska.

Important among nonstructural methods for reducing damage from flooding is the regulation of land use in flood plains combined with government sponsored insurance. The Flood Disaster Protection Act of 1973 provides for such a program to be adopted by local communities. Participation is induced by penalities and incentives. Nevertheless, not all communities have promptly qualified for full participation. A questionnaire survey of medium sized cities in Kansas, Missouri, Iowa and Nebraska found that nearly all of them were complying with the law and if not fully participating, were taking appropriate steps to do so. Many of the latter were appealing flood-hazard zone boundaries or were making appropriate structural changes to reduce the size of area vulnerable to flooding or its frequency so as to reduce the need for insurance or its cost. Though many participants in the program were critical, they felt constrained by the coercive provisions of the law. The few that did not want to participate either did not believe that they were vulnerable to flooding, or that they could eliminate the problem by structural changes.

The influence of public opinion and pressure groups did not figure significantly in local decisions. Where there was not apathy, there was more support for participation than opposition. (Baur-Weller--Kansas)
W80-02473

6G. Ecologic Impact Of Water Development

STUDIES ON THE INFLUENCE OF MAN (ANGLING) ON FRESHWATER FISH POPULATIONS IN SOUTHERN POLAND,
Polish Academy of Sciences, Krakow. Inst. of Biology.
J. M. Wlodek.
In: Proceedings: Congress in Denmark, 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 20, Part 4, 1978, p 2142-2145. 2 Tab, 8 Ref.

Descriptors: *Biomass, *Fish populations, *Poland, *Environmental effects, *Sport fishing, *Fisheries, *Recreation demand, Rivers, Fish, Population, Fishing, Recreation, Freshwater fish, Sport fish, Brown trout, Fisheries, Fish management, Mountains, Public lands.

Comparing highest observed fish biomass in three Polish drainage basins and zones in 1966-1974 to corresponding averages shows that average biomass is 75% smaller than the highest observed; 50% of the fish are caught, and most of the others are killed by other human activities. Indiscriminate angling therefore, is harmful to fish stocks, especially sport fish. Four distinct fish zones were observed: (1) high mountain, (2) mountain, (3) submontane, and (4) upper lowland. Fish biomass in a reservation where fishing is forbidden, is compared with adjacent areas where it is permitted to estimate angling pressure. In zone A adjacent to the reservation, 42.9% fish biomass is removed by anglers. Zone B angling occurs are higher than zone A: 69.7% of fish removed is by angalers. Impacts occur only with brown trout (Salmo trutta), a sport fish; in zone A 56% biomass is removed, in zone B 90% biomass is removed. Large biomass decreases in zone B are due to angling pressure: a good road exists for easy angling accessibility and the river flows through the village. East thumb (Cottus poecilopus) is not a sport fish and therefore is does not only preserve its biomass in zone A but increases it by 15%. In adjacent zone B, it decreases 63.7%; this is probably because zone B is not its natural habitat. East thumb biomass decline is propbably due to environmental rather than angling influences. (Danovich-Wisconsin).
W80-02487

EXPLOITATION OF FISHERY RESOURCES IN LAKE BALATON,
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
P. Biro.
In: Proceedings: Congress in Denmark 1977, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Vol 20, Part 4, 1978, p 2146-2149. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Lake Balaton, Hungary, *Exploitation, *Fish populations, *Commercial fishing, *Fisheries, Fish, Pikeperch, Bream, Asp, Mortality, Fishing, Eutrophication, Yield equations, Fish reproduction, Biomass, Dynamic programming, Population, Fish management, Density, Eutrophication.

Changes in pikeperch (Stizostedion lucioperca), bream (Abramis brama) and asp (Aspius aspius) populations in Lake Balaton (596 sq km) Hungary, are analyzed in relation to biotic and abiotic effects and commerical fishery exploitation. Average biomass is 9.7 kg/ha (pikeperch), 1607 kg/ha (bream), and 0.37 kg/ha (asp). Species differ greatly in population density as well as production, mortality, survival, and exploitation rates. Average annual biomass mortality loss is 375.7 MT pikeperch (65%), 59,385.5 MT bream (62%), and 10.4 MT asp (48%). Commerical fisheries remove 30%, 10.5% and 55.5% of average biomass, respectively. Other fish biomass reduction is due to sport fishing and natural mortality. Dynamic pool models show that estimated equilibrium yield-per recruits in various age groups plotted against fishing intensity vary according to fishable life-span, production, and population size and growth, as well as mortality rates. Yield-isopleths indicate heavy or slight overfishing of present populations. Due to fish kills in 1965 and 1975, the stock deteriorated. Compared to other European waters, pikeperch growth is slow, larvae and fry mortality is high, and biomass per unit area is low. Recruitment is insufficient to balance population losses. Management approaches to rectify negative cultural eutrophication effects should include measure which do not deplete primary producers. (Danovich-Wisconsin)
W80-02488

7. RESOURCES DATA

7A. Network Design

DESIGN OF A NETWORK FOR MONITORING GROUND-WATER QUALITY IN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
M. F. Hult.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price codes: $18.00 in paper copy, $6.50 in microfiche. Geological Survey open-file report 79-1164, 1979. 44 p, 13 Fig, 1 Plate, 4 Tab, 8 Ref.

Descriptors: *Network design, *Groundwater, *Water quality, *Monitoring, *Minnesota, Water wells, Aquifers, Water analysis, Baseline studies, Sampling, Chemical analysis, Maps, Sites.

A network for monitoring the quality of water in the 13 principal aquifers in Minnesota has been designed and more than 400 wells and springs selected for sampling. The network organization includes four major elements; (1) point sampling, (2) point monitoring, (3) regional monitoring, and (4) site-specific monitoring. These elements constitute monitoring strategies designed to define baseline conditions and monitor major time-and-space trends of more than 60 water-quality parameters. (Woodard-USGS)
W80-02588

7B. Data Acquisition

DIRECTORY OF WATER RESOURCES EXPERTISE.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127616, Price codes: A05 in paper copy, A01 in microfiche. California Water Resources Center, California University, Davis. Revised Edition, June 1979, 92 p. OWRT A-999-CAL(14).

Descriptors: *Scientific personnel, *Professional personnel, Research and development, Comprehensive planning, Project planning, California, *University of California, Directory.

This publication was compiled to fill a need for the identification of persons working in water resources research on the several campuses of the University for the benefit of those with the University of California as well as individuals, governmental agency personnel, and business and industrial personnel. The primary purpose is to facilitate contact between those desiring information in a specific area and those able to provide such information. (Snyder-California)
W80-02411

MERCURY-IN-GLASS THERMOMETERS FOR PRECISE TEMPERATURE MEASUREMENTS NEAR O C,
Alaska Univ., Faribanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W80-02483

A SYSTEM FOR ACCURATE TEMPERATURE CONTROL OF SMALL FLUID BATHS,
Department of Science, Melbourne (Australia). Antarctic Div.
For primary bibliographic entry see Field 2C.
W80-02484

AN INVESTIGATION OF SURFACE ALBEDO VARIATIONS DURING THE RECENT SAHEL DROUGHT,
Wisconsin Univ., Madison. Space Science and Engineering.
C. C. Norton, F. R. Mosher, and B. Hinton.
Jounal of Applied Meteorology, Vol 18, No 10, p 1252-1262, October 1979. 19 Fig, 2 Tab, 25 Ref. NASA NGR50-002-215.

Descriptors: *Albedo, *Droughts, *Deserts, *Remote sensing, Satellites(Artificial), Precipitation(Atmospheric), Rainfall, Arid climates, Arid lands, Numerical analysis, Mathematical models, Data processing, Reflectance, Climatology, Meteorology, *Sahel(Africa), *Sahara(Africa).

Applications Technology Satellite 3 green sensor data were used to measure surface reflectance variations in the Sahara/Sahel during the recent drought period 1967-74. The magnitude of the seasonal reflectance change was shown to be as much as 80% for years of normal precipitation and less than 50% for drought years. Year-to-year comparisons during both wet and dry seasons revealed the existence of a surface reflectance cycle coincident with the drought intensity. The relationship between the green reflectance and solar albedo was examined and estimated to be about 0.6 times the reflectance change observed by the green channel. (Sims-ISWS)
W80-02497

MEASUREMENT OF CONVECTIVE MEAN RAINFALL OVER SMALL AREAS USING HIGH-DENSITY RAINGAGES AND RADAR,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2B.
W80-02530

METHODS FOR DETERMINATION OF INORGANIC SUBSTANCES IN WATER AND FLUVIAL SEDIMENTS.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from Supt. of Documents, GPO Washington, DC 20402. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chapter A1, 1979. 626 p, 70 Fig, 5 Tab, 10 Ref, M. W. Skougstad, M. J. Fishman, L. C. Friedman, D. E. Erdmann, S. S. Duncan, Eds.

Descriptors: *Chemical analysis, *Inorganic compounds, *Sediments, *Water analysis, *Analytical techniques, Testing procedures, On-site tests, Laboratory tests, Laboratory equipment, Instrumentation, *Methods manual.

This manual contains more than 200 detailed analytical procedures used by the U.S. Geological Survey for the quantitative determination of 69 different inorganic constituents and properties of water and bottom material, including all the major constituents, such as calcium, sodium, alkalinity or acidity, chloride, sulfate, and nitrogen and phosphorus compounds, and a great many of the common minor constituents, including iron, manganese, aluminum, boron, copper, zinc, cadmium, lead, mercury, and others. Included are methods based on atomic absorption spectrometric, colorimetric, electrometric, gravimetric, and titrimetric techniques; many automated chemical analytical methods are given. Each method is described in detail including application, principle, interferences, apparatus and reagents required, step-by-step procedure, computations and reporting results, and precision of the method when such data are available. Methods are given for determining dissolved, total recoverable, and total concentrations of constituents in water samples, and recoverable and total concentrations of constituents in bottom material. Essential definitions are given in

the introduction. Quality control in the water-analysis laboratory is discussed, including accuracy and precision factors, the use of standard reference water samples, and the operation of an effective quality assurance program. (Woodard-USGS)
W80-02596

TRACE METAL ION FILTRATION LOSSES AT PH 5 AND 7,
New Hampshire Univ., Durham. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W80-02600

A RAPID ANALYSIS OF SURFACE WATERS BY HIGH PRESSURE LIQUID CHROMATOGRAPHY,
Wisconsin Univ.-Madison. Dept. of Soil Science.
K. Huibregtse.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-132681, Price codes: A08 in paper copy, A01 in microfiche. M.S. Thesis, 1979. 150 p, 23 Fig, 20 Tab, 86 Ref. OWRT A-069-WIS(1), 14-34-0001-6052.

Descriptors: *Chromatography, *Chemical analysis, Instrumentation, Water quality control, Water pollution, Water analysis, Water pollution sources, Industrial wastes, Municipal wastes, *Organic wastes, Pulp wastes, *High pressure liquid chromatography, High performance liquid chromatography, Reversed phase chromatography, Pollutant enrichment.

A simple rapid method for obtaining fingerprint traces of nonpolar organic contaminants in water samples by trace enrichment and high pressure liquid chromatography (HPLC) has been evolved. Samples of 30-1000 ml of river water were filtered through precolumns of a reversed-phase packing, Poracil C18. The precolumn was coupled to a high efficiency analytical column of micro-Bondapak C18 and the organic components eluted by solvent-gradient HPLC. Alternatively samples containing sediment were filtered through Sep-Paks (teflon cartridges of Poracil C18) coupled with end filters to remove the sediments. The organics were extracted from the Sep-Paks with methanol and chromatographed. Chromatograms of samples taken above, at, or below the outfalls of industrial plants, sewage treatment facilities, and other point sources of pollution clearly revealed differences in water fingerprints which indicated the extent and persistence downstream of organic contaminants. The method is suitable for rapid routine screening of water quality to help pinpoint unknown sources of organic pollutants. (Harkin-Wisconsin)
W80-02603

ELECTRIC LOGS...JUST FOR WATER WELLS,
E. C. Munson.
Pacific Ground Water Digest, Vol 2, No 11, p 18-21, November, 1979.

Descriptors: *Electrical well logging, *Water wells, Radioactive well logging, Resistivity, Borehole, Electric currents, Drillers logs, Costs, Borehole geophysics, History.

The development and use of various types of electric logging techniques is reviewed. Economics was still is an important factor in the development of the well logging industry. Recently, the use of electric logs in the water well industry has become economical due to the increased cost of water wells and difficulty in locating usable ground water in new areas. The cost of logging is usually less than 3% of the total cost of the average water well. The point resistivity log measures resistance of an electric current passing through earth material. Numerous corrections are required to obtain a true resistivity value due to borehole effects. The lateral electric and micro electric log were developed for more accurate readings. The spontaneous potential log measures very small natural currents found in the borehole. Beside electric logs, there are gamma logs which measure the natural radiation present in the borehole, caliper logs to measure the hole diameter, temperature sensors, and salinometers. Electric logs will aid in selecting the best water producing zone and in correcting problems that may develop with the casing. (Purdin-NWWA)
W80-02650

RESIN ADSORBENT TAKES ON CHLORORGANICS FROM WELL WATER,
Rohm and Haas Co., Spring House, PA. Research Div. Labs.
For primary bibliographic entry see Field 5F.
W80-02654

A DIGITAL RECORDING SYSTEM FOR TIPPING BUCKET RAINGAGES: DESCRIPTION AND FIELD TESTING,
National Hurricane and Experimental Meteorology Lab., Coral Gables, FL.
For primary bibliographic entry see Field 2B.
W80-02680

PATTERN RECOGNITION ANALYSIS OF SNOWDRIFTS,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
For primary bibliographic entry see Field 2C.
W80-02688

A COMPARISON OF SOME METHODS FOR ESTIMATION OF POTENTIAL EVAPORATION,
Royal Veterinary and Agricultural Coll. Copenhagen (Denmark). Hydrotechnical Lab.
For primary bibliographic entry see Field 2D.
W80-02689

7C. Evaluation, Processing and Publication

MAPS SHOWING GROUND-WATER CONDITIONS IN THE KANAB AREA, COCONINO AND MOHAVE COUNTIES, ARIZONA--1976,
Geological survey, Tucson, AZ. Water Resources Div.
G. W. Levings, and C. D. Farrar.
Geological Survey open-file report 79-1070 (WRI), June 1979. 2 Sheets, 9 Ref.

Descriptors: *Groundwater, *Mapping, *Aquifer characteristics, *Water table, *Water quality, Hydrogeology, Subsurface mapping, Water yield, Irrigation, Water wells, Water analysis, Specific conductivity, Fluorides, Arizona, *Kanab area(AZ), *Coconino County(AZ), *Mohave County(AZ).

The Kanab area includes about 3,500 square miles in northwestern Arizona. Ground water is obtained from several aquifers that are made up of one or more formations. The aquifers overlie one another and generally are not hydraulically connected because of intervening impermeable beds. The formations that yield water to wells and springs are the alluvium; basalt; N aquifer, which consists of the Navajo Sandstone, Kayenta Formation, and Moenave Formation; Shinarump Member of the Chinle formation; Moenkopi Formation; Kaibab Limestone; Toroweap Formation; Supai Group; and Muav Limestone. Although several of the aquifer underlie most of the Kanab area, they are dry in places. Ground-water development has been slight, and in 1976 the estimated pumpage was slightly more than 2,000 acre-feet, most of which was used for irrigation in the Short-Cane Beds area. Information shown on the maps, scale 1:125,000, includes the principal aquifer that furnishes water to wells and springs, depth to water, altitude of the water level, specfic conductance, and fluoride concentration. (Woodard-USGS)
W80-02589

WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1978--VOLUME 2. DELAWARE RIVER BASIN AND TRIBUTARIES TO DELAWARE BAY,
Geological Survey, Trenton, NJ. Water Resurces Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116536, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NJ-78-2, June 1979. 302 p, 14 Fig, 5 Tab, 36 Ref.

Descriptors: *New Jersey, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Delaware River Basin(NJ), Delaware Bay tributaries(NJ).

Water resources data for the 1978 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the Delaware River basin and tributaries to Delaware Bay and contains discharge records for 22 gaging stations: tide summaries for 4 stations; stage and contents for 16 lakes and reservoirs; water quality for 17 gaging stations, 80 partial-record flow stations, and 51 wells; and water levels for 8 observation wells. Also included are 27 crest-stage partial-record stations and 19 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (Woodard-USGS)
W80-02598

WATER RESOURCES DATA FOR OREGON, WATER YEAR 1978.
Geological Survey, Portland, OR. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-122344, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report OR-78-1, June 1979. 650 p, 5 Fig, 1 Tab.

Descriptors: *Oregon, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Oregon consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 278 gaging stations, stage only records for 10 gaging stations, stage and contents for 44 lakes and reservoirs, water quality for 85 gaging stations, and water levels for 95 observation wells. Also included are 91 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Oregon. (Woodard-USGS)
W80-02599

DISPERSION MODELING IN TIME AND TWO DIMENSIONS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
J. F. Henry, and E. G. Foree.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 105, No EE6, p 1131-1147, December, 1979. 11 Fig, 9 Ref, 1 Append.

Descriptors: *Mathematical models, *Dispersion, Water pollution, Environmental effects, Coal, Waste disposal wells, Injection wells.

A two-dimensional dispersion model for predicting pollutant spread and resultant impacts is described. This model approximates complicated mathematical expressions to derive an equation for disper-

sion profiles which can be quickly solved arithmetically on a hand-held calculator. Three uses of the model in environmental impact studies are described. These are: (1) determining the extent of ground water pollution from an underground coal gasification operation; (2) estimating the spread of wastes injected into a deep well; and calculating the extent of vinyl chloride atmospheric emissions from a polyvinyl chloride plant. Since the utility of the model has not been fully investigated, it should be used for preliminary environmental impact calculations rather than as the basis for definitive engineering design work. (Purdin-NWWA)
W80-02664

REAL-TIME ESTIMATION OF VELOCITY AND COVARIANCE STRUCTURE OF RAINFALL EVENTS USING TELEMETERED RAINGAGE DATA--A COMPARISON OF METHODS,
National Weather Service, Silver Spring, MD. Hydrologic Research Lab.
For primary bibliographic entry see Field 2B.
W80-02678

SPATIAL CORRELATIONS OF PRECIPITATION IN NORTHWEST GEORGIA,
Oak Ridge National Lab., TN. Engineering Technology Div.
For primary bibliographic entry see Field 2B.
W80-02698

8. ENGINEERING WORKS

8A. Structures

UNDERWATER TERRAIN REINFORCEMENT MATTING,
Akzona, Inc., Asheville, NC. (Assignee).
J. G. Vos, B. H. Daimler, W. Herveling, A. Birker, and S. Langefeld.
U.S. Patent No 4,168,335, 5 p, 8 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 986, No 3, p 689, September 18, 1979.

Descriptors: *Patents, *Erosion control, *Channel erosion, Underwater, Materials, Matting, Nonwoven matting.

A matting is disclosed for reinforcing underwater terrains. The matting is made of sections of looped intersecting synthetic polymer filaments bonded to one another at their points of intersection, at least one section being temporarily buoyant in water. The matting may be towed into position and then submerged. The advantage of such a matting lies in its open, low density structure. The structure allows sand, plant growth and other particles to become easily entrapped within the matting. The entrapped particles act as effective anchors for the matting and allows the matting to effectively blend into the underwater landscape. (Sinha - OEIS)
W80-02618

WATER INTAKE DEVICE,
W. L. Dovel.
U.S. Patent No 4,169,792, 6 p, 5 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 987, No 1, p 169-170, October 2, 1979.

Descriptors: *Patents, *Industrial water, *Cooling water, *Intakes, Fish barriers, Filtration, Screens, Intakes structures, Backwashing.

A water intake device for supplying water for use in the operation of power plants and other installations which require a large volume of water is described. To prevent screen clogging and/or fish kill, various techniques and screens are used to prevent the fish from entering the cooling water intake. In this invention a water intake device comprises a movable screen, such as a cylindrical rotatable screen, adapted to be partially submerged in a body of water. As the water flows through the screen, backwashing such as jets of water, direct water at a segment of the screen as that section moves. The jets of water serve to clear and/or remove objects or fish caught on the outside of the screen. Duct means are also provided for a flow channel for the objects or fish removed from the screen. The duct means are dimensioned and positioned so as to carry objects or fish beyond the pull or suction of the water entering the screen. (Sinha-OEIS)
W80-02631

DAM WITH SUSPENDED HYDROELECTRIC STATION,
F. J. G. Atencio.
U.S. Patent No 4,170,428, 6 p, 4 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 987, No 2, p 390, October 9, 1979.

Descriptors: *Patents, *Engineering structures, *Dams, *Dam design, Water storage, Pumped storage, Hydroelectric plants, Buoyancy.

The invention relates generally to dams having hydroelectric stations erected in river watersheds for the purpose of energy generation-transformation, navigation development, flood control and the provision of good water storage for flood control. It is intended to include reversible pumped-storage electric power systems. A dam body of considerable less mass is required due to the suspended feature of the associated hydromotive assembly and the introduction of the substantially horizontal-axis engineering concept. The hydromotive assembly includes integral buoyancy means for maintaining it in a suspended operable position. A further reduction in construction cost may be realized by incorporating a diffuser downstream of each water passage as an integral part of the dam body. (Sinha-OEIS)
W80-02634

FIBERGLASS CASING USED IN CORROSIVE GEOTHERMAL WELLS,
Campagnie Francaise des Petroles, Paris (France).
P. J. Angles.
Oil & Gas Journal, Vol 77, No 42. p 131-132, October 15, 1979. 2 Tab.

Descriptors: *Geothermal studies, *Well casing, *Plastic pipes, Cement grouting, Drilling, Injection wells, Corrosion.

Fiberglass reinforced epoxy pipe was used as production and injection casing for a geothermal district heating project near Paris, France. It has similar thread design and mechanical properties as steel casing and greater corrosion resistance and cement adherence. No problems were encountered during installation of the casing in a 25 degree deviated well and results have been satisfactory. This type of casing is presently limited to depths of 2,000 m (6600 ft). However, new design and fabrication techniques will enable this pipe to be used in deeper deviated wells. Cement-lined casing was rejected in favor of fiberglass casing due to uncertainty of continuous lining, turbulent effect on lining at joints, and possible damage to lining at joints, and possible damage to lining during handling and operation. (Purdin-NWWA)
W80-02652

SAFETY AT THE DRILL SITE OF CONCERN TO DRILLERS,
A. Hewitson.
Canadian Water Well, Vol 5, No 4, p 12-13, November, 1979.

Descriptors: *Safety, *Hazards, *Drilling, Electrical equipment, Explosions, Natural gas, Accident.

Water well drilling has a better record of accident frequency than general construction. The most common hazards faced by well drillers are electrical shock from contacting overhead wires or electrical equipment, explosions of gas cylinders, and natural gas pockets. To avoid accidents, drilling rigs should be kept far enough from live power lines, preventive maintenance programs should include regular testing of all power tools, and explosion-proof shelters and portable vent fans should be used. (Purdin-NWWA)
W80-02653

PRIMITIVE WELL DRILLING TECHNIQUES: PART II,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol 33, No 11, p 34-35, October, 1979. 2 Fig.

Descriptors: *Roary drilling, *History, *Technology, Earth augers, Drilling fluids.

The development of rotary drilling technology is discussed from a historical veiwpoint. Early rotary drilling consisted of either 'pod' or helical earth augers depending on soil type. They were capable of drilling deep wells but were inefficient until the mid 1840's when fluid circulation was used to flush cuttings from the hole. Another improvement occurred around 1890 with the invention of the rotary table. (Purdin-NWWA)
W80-02656

COLLAPSE PRESSURE OF THERMOPLASTIC WATER WELL CASINGS,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8G.
W80-02659

NEW RIG DRILL AND SET CASING SIMULTANEOUSLY,
For primary bibliographic entry see Field 8C.
W80-02660

GEOTHERMAL: AN IDEA WHOSE TIME HAS COME...,
Pacific Ground Water Digest, Vol 2, No 11, p 43-44, November, 1979.

Descriptors: *Geothermal studies, *Wood wastes, *Power plants, Feasibility studies, California, Greenhouses.

The U.S. Department of Energy has begun funding of feasibility studies of a unique hybrid power plant located near Susanville, California. It would be the first to combine low temperature geothermal energy with a wood waste burner to provide steam for a 55 MW power plant. In addition, geothermal effluent at approximately 100F will heat 200 greenhouses at the site. If proved feasible, the project could be in operation by 1985. If successful, similar power plants will be established in the western states where low temperature geothermal resources often coincide with forest areas. (Purdin-NWWA)
W80-02662

HOW GEOTHERMAL WELLS ARE COMPLETED AND PRODUCED,
Completion Technology Co., Houston, TX.
R. E. Synder.
World Oil, Vol 189, No 5, p 81-87, October, 1979. 14 Ref.

Descriptors: *Geothermal studies, *Well casings, *Wells, *Cement grouting, Injection wells, Corrosion, Scaling, Failure(Mechanics), Damages.

The state of the art technology, recognized problems and limitations relevant to completion and production of geothermal wells are examined. Typical geothermal wells produce low pressure steam or hot brine from shallow (5000-9000 feet) depths but effects of high temperatue and 100% aqueous environment create unique problems with casing and serious primary cementing limitations. Possible causes of casing failure in geothermal wells include formation loading, mechanical damage, corrosion and scaling, thermal stress, metal failure, and entrapped fluid expansion. To avoid these problems casing should be constructed of moderate strength steels of the correct weight and grade and joined together with API Buttress type couplings. Lost circulation and crossflow, excessive mud gellation and staging tool failures contribute to inefficient and/or incomplete placement of cement even with modern high-temperature cements. The use of uncemented, slotted liners over long productive intervals is an economic al-

ternative to expensive and difficult cementing and perforating. However, this may result in long range sand pumping problems. (Purdin-NWWA)
W80-02665

TESTS SHOW METHODS FOR IMPROVED GRAVEL PACKING,
Chevron Oil Field Research Co., La Habra, CA.
S. G. Shryock.
World Oil, Vol 188, No 2, p 55-58, August 1, 1979. 5 Fig, 2 Tab.

Descriptors: *Gravels, *Well filters, *Physical models, Particle size, Well screens, Erosion control, Compaction, Packed beds, Porosity, Soil density, Mixing, Turbulence.

Gravel packs are used to prevent sand production in wells completed in unconsolidated formations. Gravel packing mechanics were studied in a full-scale transparent well bore model. This helped determine the effects of six parameters on the placement and performance of gravel pack completion. These are: gravel quality, slot sizing, crossover port damage, carrier fluids, pack washing problems, and grvael compaction. Undersized particles and fines reduce flow capacity of both gravel and screen. Slot width should be equal to or less than the samllest grain diameter of the gravel. Shattering of gravel at the crossover port and resulting fines production was reduced by increasing the diameter of the crossover port from 1 to 1.5 inches to decrease the exit velocity. Viscous carrier fluids eliminate fines buildup from recirculation, can transport higher concentration without erosion and support the open hole to prevent sloughing during completion operations. Turbulent washing does not settle the gravel pack and may introduce formation sand into it. The tighter the gravel can be placed, the better the pack will perform in controlling sand production. (Purdin-NWWA)
W80-02666

ENERGY-DISSIPATING BYPASS FOR HYDROELECTRIC POWERHOUSE,
Westinghouse Electric Corp., Sunnyvale, CA.
For primary bibliographic entry see Field 8B.
W80-02697

8B. Hydraulics

MINING EARTH'S HEAT: HOT DRY ROCK GEOTHERMAL ENERGY,
Los Alamos Scientific Lab., NM.
For primary bibliographic entry see Field 8E.
W80-02651

PRIMITIVE WELL DRILLING TECHNIQUES: PART II,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 8A.
W80-02656

TESTS SHOW METHODS FOR IMPROVED GRAVEL PACKING,
Chevron Oil Field Research Co., La Habra, CA.
For primary bibliographic entry see Field 8A.
W80-02666

TURBULENT JETS IN CO-FLOWING STREAMS,
Alberta Univ., Edmonton, Dept. of Civil Engineering.
P. B. B. Lal, and N. Rajaratnam.
Journal of the Engineering Mechanics Division, American Society of Civil Engineers, Vol 105, No EM6, Proceedings Paper 15043, p 1025-1038, December 1979. 6 Fig, 15 Ref, 3 Append.

Descriptors: *Jets, *Momentum equation, *Turbulent flow, *Continuity equation, Velocity, Turbulence, Fluid mechanics, Analysis, Profiles, *Submerged jets, Similarity, Velocity profiles.

This paper presented a method for prediciting the variation of the velocity and length scales for plane and circular turbulent jets issuing into co-flowing streams. The basis of this method is an assumed variation in the turbulence production integral in the transition region from the strong jet to the weak jet. The solution is built around the integral momentum and energy equations. The predictions from this method agree well with the experimenal results for both plane and circular jets. (Adams-ISWS)
W80-02691

MASS TRANSFER VERIFICATIONS OF TIDAL FROUDE MODELS,
Old Domnion Univ., Norfolk, VA.
For primary bibliographic entry see Field 2L.
W80-02695

ENERGY-DISSIPATING BYPASS FOR HYDROELECTRIC POWERHOUSE,
Westinghouse Electric Corp., Sunnyvale, CA.
E. F. Goedde, V. G. Guins, and R. P. Strumpf.
Journal of the Hydraulic Division, American Society of Civil Engineers, Vol 105, No HY12, Proceedings Paper 15070, p 1487-1499, December 1979. 7 Fig, 2 Tab, 2 Ref, 1 Append.

Descriptors: *Aeration, *Hydroelectric power, *Energy dissipation, Cavitation, Energy, Valves, Hydraulic jump, Bypasses, Hydroelectric plants, Jets, Baffles, *Absorbers, Bypass valves, Needle valves, Regulators, Relief valves.

A hydraulic energy-dissipating bypass system for continuous flow operation in a hydro-electric power plant was described. Difficulties with cavitation, flow separation, vibration, and mechanical failure are encountered in many existing bypass systems. These difficulties increase with the pressure head. This paper described the design principles and features of a high-head bypass system that successfully eliminates these difficulties and discharges a steady, uniform, low velocity flow at its outlet. The bypass system consists of a needle valve, an air entrainment system or energy-absorber cone, and a energy-absorbing stilling chamber with attached outlet duct. Modifications to the system were described, including the installation of baffle blocks in the outlet duct. Full-scale tests verifying system performance by pressure and flow velocity measurements were described. (Lee-ISWS)
W80-02697

8C. Hydraulic Machinery

WATER DISTRIBUTION CHAMBER FOR AN ELECTRIC STEAM GENERATOR,
CAM Industries Inc., Kent, WA. (Assignee).
R. N. Coates.
U.S. Patent No 4,169,558, 6 p, 6 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 987, No 1, p 97, October 2, 1979.

Descriptors: *Patents, *Water control, *Industrial water, Flow control, Waves(Water), Fluctuations, Baffles, Boilers, Steam, Steam generators.

Horizontal damping elements are arranged in the water distribution chamber to damp out wave action in the water flowing to the individual compartments formed by vertical baffles. The damping elements may be integral with the baffles to form one-piece members or may be formed of flat plates separate from the baffles. The dampening elements prevent periodic fluctuations from occurring in the water streams from which steam is produced and thus fluctuations in the amounts of generated steam. (Sinha-OEIS)
W80-02628

DREDGE WITH ROTATABLE CUTTER DISCS,
M. L. Holekamp.
U.S. Patent No 4,170,079, 11 p, 14 Fig, 25 Ref; Official Gazette of the United States Patent Office, Vol 987, No 2, p 272, October 9, 1979.

Descriptors: *Patents, *Dredging, *Hydraulic equipment, Channel improvement, Excavation, Boats, Pontoons.

In a vessel-mounted dreding device material freed by revolving cutters is pumped through a suction mouth and discharge pipe to a place remote from the cutters. A platform, upon which a pump is mounted, and beneath which cutter discs are mounted, is itself mounted to the lower end of a mast. The mast arranged for movement vertically with respect to a vessel is mounted upon the bow. The vessel is made with main pontoons running fore and aft, spaced from one another about the center line of the vessel a distance sufficient to accommodate a discharge pipe. One end is connected to the discharge side of the pump, and the other end is cradled on rollers, permitting lengthwise translation of the discharge pipe as the pump is moved up and down by the mast. The cutter discs are equipped with trapezoidal teeth oriented generally parallel to the axis of rotation of the discs, and pivotally mounted on the discs on pivot axes parallel to the axis of rotation of the disc, in such a way that the teeth can swing to either side of a radius. In the preferred embodiment, two cutting discs are provided, with axes of rotation aligned in the fore and aft direction with respect to the vessel. The cutter discs lie in the same plane and are spaced from one another below a suction inlet of the pump. The cutter discs are rotated by hydraulic motors. (Sinha-OEIS)
W80-02632

THE GROUND-WATER GEOTHERMAL HEAT PUMP: AN IDEA WHOSE TIME HAS COME,
National Water Well Association, Worthington, OH.
J. H. Lehr.
Ground Water, Vol 17, No 6, p 522-523, November-December, 1979.

Descriptors: *Heat pumps, *Water districts, *Rural areas, Heating, Ground water, Geothermal studies, Water yield, Water wells.

Ground-water heat pumps have the potential of saving 25 million barrels of oil per year if they are installed in one million rural and suburban homes that already have a water supply well. Since annual energy savings from ground-water heat pumps average $600 to $800, the $1200 to $1500 initial investment for a recharge well can be repaid within two years. The controversy over unnecessary rural water districts (RWD) will now include the advantages of ground-water heat pumps. Few RWD's can be designed to economically supply enough water to fuel the ground water heat pump, while individual wells with a yield as low as two gpm would be adequate. (Purdin-NWWA)
W80-02649

NEW RIG DRILL AND SET CASING SIMULTANEOUSLY,
Canadian Water Well, Vol 5, No 4, p 17, November, 1979.

Descriptors: *Rotary drilling, *Well casing, *Drilling equipment, Hydraulic equipment, Hoisting machinery.

The Barber Dual 12-24 rotary drilling rig is capable of setting casing while drilling. The top rotary drive is lifted and swings sideways to lift drill pipe or casing while the lower rotary drive continues drilling. The casing is rotated as it is being set, eliminating the need for a casing driver. The rig also has the advantage of a completely hydraulic hoisting system which greatly improves operator safety and reduced maintenance cost and downtime. (Purdin-NWWA)
W80-02660

8D. Soil Mechanics

COLLAPSE PRESSURE OF THERMOPLASTIC WATER WELL CASINGS,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8G.
W80-02659

8E. Rock Mechanics and Geology

MINING EARTH'S HEAT: HOT DRY ROCK GEOTHERMAL ENERGY,
Los Alamos Scientific Lab., NM.
R. G. Cummings, G. E. Morris, J. W. Tester, and R. L. Bivins.
Technology Review, p 58-78, February, 1979. 18 Fig, 33 Ref.

Descriptors: *Geothermal studies, *Rocks, Electric power, Economic feasibility, Fractures, Injection wells, Cooling, Optimization.

The potential geothermal resource base of hot dry rock (HDR) reservoirs is estimated to be 13 million quads. However, only 0.2% is technically recoverable. HDR reservoirs with low permeabilities required the formation of fracture zones through hydraulic fracturing, injection of cool water and recovery of heated water. In formations with hgih permeabilities, water drive and flooding methods should be used to minimize fluid loss. The thermal drawdown or cooling rate for a fractured, low permeability HDR reservoir depends on the accessible fracture surface area, mass flow rate, fluid distribution, and density, heat capacity, and thermal conductivity of the rock. Optimization of the resource would minimize the thermal drawdown while maximizing the mass flow rate. The operation of an HDR system should have minimum enviornmental impact. However. exerimental and economic research is required before a definitive assessment of the commercial feasibility of HDR-produced electricity can be made. (Purdin-NWWA)
W80-02651

8F. Concrete

HOW GEOTHERMAL WELLS ARE COMPLETED AND PRODUCED,
Completion Technology Co., Houston, TX.
For primary bibliographic entry see Field 8A.
W80-02665

8G. Materials

UNDERWATER TERRAIN REINFORCEMENT MATTING,
Akzona, Inc., Asheville, NC. (Assignee).
For primary bibliographic entry see Field 8A.
W80-02618

FIBERGLASS CASING USED IN CORROSIVE GEOTHERMAL WELLS,
Campagnie Francaise des Petroles, Paris (France).
For primary bibliographic entry see Field 8A.
W80-02652

COLLAPSE PRESSURE OF THERMOPLASTIC WATER WELL CASINGS,
Auburn Univ., AL. Dept. of Civil Engineering.
C. E. Kurt.
Ground Water, Vol 17, No 6, p 550-555, November-December, 1979. 8 Fig, 9 Ref.

Descriptors: *Well casings, *Plastic pipes, *Collapse, Standards, Loads, Pressure, Soil strength, Equations, Buckling, Soil pressure.

The collapse pressure resistance of thermoplastic water well casing will increase due to the support of surrounding material. The equilibrium equations of Morley for uniform and linearly varying radial collapse pressure loading conditions were modified to include the effects of soil support and were solved using the Galerkin method. Simple formulas are proposed for predicting collapse for the two loading conditions considered. Collapse pressures predicted by the proposed formula for uniform collapse pressure are approximately 25% lower than those values predicted by the current collapse formula given in ASTM Standard F480. Collapse pressures for linearly varying pressure were 12% higher than the corresponding values for uniform pressure. Other factors that may affect actual collapse pressures are: uniformity of wall thickness, out-of-roundness, rate of loading, and heat of hydration during grouting. (Purdin-NWWA)
W80-02659

HOW GEOTHERMAL WELLS ARE COMPLETED AND PRODUCED,
Completion Technology Co., Houston, TX.
For primary bibliographic entry see Field 8A.
W80-02665

8H. Rapid Excavation

GROUND WATER CONTROL TO THE RESCUE: TWO CASE HISTORIES,
Golder Associates, Mississauga (Ontario).
J. L. Seychuk, and L. R. Lahti.
Canadian Geotechnical Journal, Vol 16, No 4, p 716-733, December, 1979. 25 Fig, 1 Tab, 2 Ref.

Descriptors: *Dewatering, *Excavation, *Seepage conrol, Drainage wells, Water levels, Tunnel construction, Shafts(Excavations), Subsurface investigations, Cofferdams, Well points.

Two case histories of dewatering during excavation are discussed. The first case involved the construction of a sewer tunnel within a layered silty clay sandwiched between two water-bearing, granular deposits. Local water-bearing depressions in the upper clay layer caused several collapses of the tunnel roof. The groundwater level was subsequently lowered by means of an eductor well system, allowing the completion of the tunnel in relatively dry conditions. The second case involved the sinking of a 21 m deep exploratory mine shaft through water-bearing silts and sands. After three unsuccessful attempts without ground water control, eductor wells were installed around a steel sheet pile cofferdam to permit the successful sinking of the shaft to bedrock. These two case histories illustrate the value of adequate ground water investigations to avoid costly excavation problems. (Purdin-NWWA)
W80-02648

8I. Fisheries Engineering

RANGE OF CHANGES IN FISHPOND ENVIRONMENT INFLUENCED BY INTENSIVE CARP FARMING,
Polish Academy of Sciences, Golysz. Fish Culture Station.
For primary bibliographic entry see Field 5C.
W80-02486

STUDIES ON THE INFLUENCE OF MAN (ANGLING) ON FRESHWATER FISH POPULATIONS IN SOUTHERN POLAND,
Polish Academy of Sciences, Krakow. Inst. of Biology.
For primary bibliographic entry see Field 6G.
W80-02487

EXPLOITATION OF FISHERY RESOURCES IN LAKE BALATON,
Magyar Tudomanyos Akademia, Tihany. Biological Research Inst.
For primary bibliographic entry see Field 6G.
W80-02488

ENDOHELMINTHS OF SALMONIDA FROM THE ARTIFICIAL LAKE PIVA, MONTENEGRO, YUGOSLAVIA,
Biological Inst., Titograd (Yugoslavia).
For primary bibliographic entry see Field 5C.
W80-02490

UNIQUE CHARACTERISTICS OF ICHTHYOFAUNA AND ICHTHYOPARASITES OF SKADAR LAKE,
Biological inst., Titograd (Yugoslavia).
For primary bibliographic entry see Field 5C.
W80-02492

10. SCIENTIFIC AND TECHNICAL INFORMATION

10D. Specialized Information Center Services

DIRECTORY OF WATER RESOURCES EXPERTISE.
For primary bibliographic entry see Field 7B.
W80-02411

PUBLICATIONS RELATED TO THE NATIONAL WATER DATA EXCHANGE (NAWDEX)--1971-79,
Geological Survey, Reston, VA. Water Resources Div.
Availability: OFSS, USGS Box 25425 Denver, CO 80225. Microfiche $3.50, Paper copy, $2.25. Geological Survey open-file report 79-1299, 1979. 16 p.
B. M. Myers, compiler.

Descriptors: *Bibliographies, *Publications, *Abstracts, *Data storage and retrieval, Water resources, *National Water Data Exchange(NAWDEX).

The National Water Data Exchange (NAWDEX), formally established in January 1976, is a national confederation of water-oriented organizations working to improve access to water data. Its primary objective is to assist users of water data in the identification, location, and acquistion of useful data. NAWDEX is coordinated by a central Program Office, located within the Water Resources Division of the U.S. Geological Survey, which provides data-exchange policy and guidelines to all participants in the program. In addition to the Program Office, there is a network of Assistance Centers located in 45 States and Puerto Rico which provides direct access to NAWDEX. Membership in NAWDEX is voluntary and open to any water-oriented organization that wishes to participate. This publication contains an alphabetical listing, by author, of the reports that have been produced by the NAWDEX Program Office since 1975, as well as reports from other sources that relate to the development of the NAWDEX program. (Woodard-USGS)
W80-02593

10F. Preparation Of Reviews

MECHANICS OF SEDIMENT TRANSPORTATION AND ALLUVIAL STREAM PROBLEMS,
Roorkee Univ. (India).
For primary bibliographic entry see Field 2J.
W80-02700

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 8
APRIL 15, 1980

'80-02701 -- W80-03000
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 8
APRIL 15, 1980

W80-02701 -- W80-03000

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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01 NATURE OF WATER

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02 WATER CYCLE

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

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Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

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Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

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Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

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ABSTRACT SOURCES

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

THE EFFECT OF THE ANAESTHETIC BENZOCAINE HYDROCHLORIDE ON FRESHWATER QUALITY,
Randse Afrikaanse Univ., Johannesburg (South Africa). Navorsingsgroep vir Varswaterbiologie.
J. T. Ferreira, G. L. Smit, and H. J. Schoonbee.
Water S. A., Vol 5, No 3, p 123-127, July 1979. 1 Fig, 4 Tab, 9 Ref.

Descriptors: *Freshwater fish, *Water properties, *Fish physiology, Fish handling facilities, Chemical properties, Water chemistry, Volumetric analysis, Boreholes, Distillation, Sodium compounds, Hardness(Water), Alkalinity, Calcium, Tapwater, Anaesthetics, Benzocaine hydrochloride.

Benzocaine hydrochloride, a commonly used fish anaesthetic, produces chemical and physical changes in freshwater. Because fish haematology is often used for health measurements, any changes in water parameters that may be reflected in fish haematology are of significance. Benzocaine hydrochloride was added to samples of tapwater, boreholewater, and distilled water in concentrations of 50, 80, and 100 mg/cubic decimeter. Water quality parameters measured were pH, p02, pC02, conductivity, alkalinity, and calcium hardness. Values were taken after 5, 30, 60, 90, and 240 minutes. Benzocaine hydrochloride neutralized with sodium hydroxide was also tested. Results show that the benzocaine hydrochloride caused drastic changes for the tested parameters in tapwater and boreholewater, while distilled water showed only conductivity changes. Water pC02 values for tapwater and boreholewater increased with increasing benzocaine hydrochloride concentrations and with time. Tapwater also had the highest calcium hardness. The benzocaine hydrochloride neutralized with sodium hydrochloride tests showed that no changes occurred in any water quality parameters except for an increase in conductivity in distilled water. (Seigler-IPA)
W80-02752

MICROCOMPUTER COMPATIBLE METHOD OF RESOLVING RATE CONSTANTS IN MIXED FIRST- AND SECOND-ORDER KINETIC RATE LAWS,
Nebraska Univ., Lincoln. Dept. of Chemistry.
P. B. Kelter, and J. D. Carr.
Analytical Chemistry, Vol 51, p 1828-1834, September 1979. 1 Fig, 6 Tab, 7 Ref, 2 Append.

Descriptors: *Chemical reactions, *Kinetics, *Rates, *Mathematical models, Model studies, Theoretical analysis, Oxidation, Computer models, Simulation analysis, Optimization.

A fast reliable method of kinetic data treatment for systems having first-order and second-order reactions occurring in parallel is developed. The method, an extention of a R. G. Cornell technique, can also be applied to mixed-order systems. It is designed for use on a microcomputer or programmable calculator. Absorbance versus time data is used to calculate the rate constants at zero time. Reaction values from both simulated and real data are determined. Fo the simulated data both noiseless and noisy data is used to cover a broad range of conditions. The simulated data is also used to illustrate method limitations and to suggest methods of data collection optimization. Reaction values are presented from the oxidation of aqueous formic acid by ferrate (VI) ion under pseudo-first-order conditions. Results obtained from application of the method are compared with those from standard methods such as graphical means and Fletcher-Powell minimization. The comparison shows good agreement for the values. (Seigler-IPA)
W80-02759

THE WATERS OF HOT SPRINGS NATIONAL PARK, ARKANSAS--THEIR NATURE AND ORIGIN,
Geological Survey, Lakewood, CO. Water Resources Div.; and Geological Survey, Reston, VA. Water Resources Div.; and Geological Survey, Little Rock, AR. Water Resources Div.
M. S. Bedinger, F. J. Pearson Jr., J. E. Reed, R. T. Sniegocki, and C. G. Stone.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.00 Geological Survey Professional Paper 1044-C, 1979. 33 p, 13 Fig, 1 Plate, 11 Tab.

Descriptors: *Geothermal studies, *Thermal springs, *Water temperature, *Hydrogeology, *Water chemistry, Groundwater movement, Radioactive dating, Groundwater recharge, Water quality, Dissolved solids, Silica, Model studies, Flow system, Evaluation, Arkansas, *Hot Springs National Park(Ark).

The hot springs of Hot Springs National Park, Arkansas, issue from the Hot Springs Sandstone Member of the Stanley Shale of Mississippian age at the crest of a plunging overturned anticline, along the southern margin of the Ouachita anticlinorium. The combined flow of the 47 hot springs ranges from 750,000 to 950,000 gallons per day. The temperature of the combined hot-springs water is about 62 Celsius. The maximum temperature of the water at depth is estimated to be not more than a few degrees Celsius higher than the temperature at the surface. Maximum temperature measurements since 1804 indicate a small decline in temperature with time. Tritium and Carbon-14 analyses of the water indicate that the water is a mixture of a very small amount of water less than 20 years old and a preponderance of water about 4,400 years old. The dissolved solids concentrations range from 175 to 200 milligrams per liter. The main differences in the quality of the hot water, compared with the nearby cold ground water, are the high temperature and higher silica concentrations of the hot springs. Mathematical models were employed to test various conceptual models of the hot-springs flow system. (Woodard-USGS)
W80-02929

1B. Aqueous Solutions and Suspensions

ADSORPTION OF LEAD FROM SOLUTION ON THE QUARTZ- AND FELDSPAR-CONTAINING SILT FRACTION OF A NATURAL STREAMBED SEDIMENT,
Geological Survey, Menlo Park, CA. Water Resources Div.
D. W. Brown.
In: Chemical Modeling in Aqueous Systems, Speciation ACS Symposium Series 93: American Chemical Society, Washington, District of Columbia, p 238-260, 1979. 10 Fig, 1 Tab, 16 Ref.

Descriptors: *Model studies, *Lead, *Adsorption, *Streambeds, *Bottom sediments, Water chemistry, Chemical reactions, Cation exchange, Sorption, Surface, *Lead adsorption, Electrical double-layer, Surface charge, Surface potential.

The extensive use of lead antiknock additives in gasoline has made lead perhaps the most widely distributed toxic heavy metal in the urban environment and has greatly increased its availability for solution in natural waters. In a natural water system the chemical processes that can greatly vary the concentration of lead are those of complex formation, solution-precipitation, and adsorption. This paper presents a comprehensive method for evaluating the surface characteristics needed to predict the adsorption behavior of lead on the silt fraction of sediments from a natural streambed. Also presented is a quantitative description of lead adsorption on such material primarily as a function of pH between 4 and 8, the range most commonly encountered in natural waters. (Woodard-USGS)
W80-02918

2. WATER CYCLE

2A. General

MICROBIOLOGICAL STUDY OF STORM RUNOFF WATERS FROM A 100% RESIDENTIAL AREA IN CANADA,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W80-02728

BIBLIOGRAPHY OF WATER QUALITY BRANCH PUBLICATIONS 1978.
Department of the Environment Ottawa (Ontario). Water Quality Branch.
Ottawa, Ontario, Canada 1979, English and French. 15 p, 1 App.

Descriptors: *Bibliographies, *Water quality, Aquatic habitats, Data storage and retrieval, Monitoring, Sampling, Sediments, Precipitation, Canada.

This bibliography lists studies carried out by the Water Quality Branch in 1978. Titles of reports plus a brief abstract and a contact person for further information are included. (WATDOC)
W80-02834

ANALYSIS AND USE OF URBAN RAINFALL DATA IN CANADA.
Howard (Charles) and Associates Ltd., Ottawa (Ontario).
Available from Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada, K1A 1C8. Economic and Technical Review Report EPS 3-WP-79-4, July 1979, 35 p, 8 Fig, 11 Tab, 1 App.

Descriptors: *Rainfall, *Storm water, *Urban runoff, *Statistics, Moisture deficit, Analytical techniques, Data collections, Probability, Toronto, Ontario.

Rainfall data available for 35 Canadian urban centres were analysed and are summarized in this report. This information has been assembled as a guide to engineers involved in the design of urban runoff and pollution control facilities. The results of the rainfall storm event analyses consist of yearly tables summarizing each rainfall event, and statistical tables for four rainfall storm event characteristics: storm depth (total volume); storm duration (length of event); average storm intensity (depth divided by duration), and storm inter-event time (the length of time without rain preceding the event). Statistical tables of moisture deficit estimates are also given. The table summarizing rainfall events provides a quick reference for the design engineer in choosing either specific events, series of events or years of data for design studies. The statistical tables provide information for the calculation of the probability and return period for specific storm events. The calculation of accurate probability and return periods depends on an understanding of the physical system and the important characteristics of a particular rainfall event. In many practical design situations, the joint probability of two or more rainfall event characteristics is required to accurately calculate the return period. The significance of the independence of rainfall event characteristics in these calculations is presented as an appendix to this report. (WATDOC)
W80-02839

HYDROGEOLOGY OF GLACIAL-TERRAIN LAKES, WITH MANAGEMENT AND PLANNING APPLICATIONS,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
S. M. Born, S. A. Smith, and D. A. Stephenson.
Journal of Hydrology, Vol 43, No 1/4, p 7-43, October 1979. 8 Fig, 4 Tab, 102 Ref, 1 Append.

Descriptors: *Surface-groundwater relationships, *Lakes, *Hydrogeology, *Groundwater, *Planning, *Hydrologic budget, Glaciation, Ground-

water movement, Water levels, Water balance, Flow system, Regime, Water table, Classification, Groundwater recharge, Kettle lakes, System efficiency, Flow through, Lake flushing rates.

The subject of the relationship between groundwater and lakes is characterized by sparse information and, in general, has received limited attention by hydrologists. Nevertheless, the hydrogeologic regime of lakes must be adequately assessed in order to intelligently manage lakes and their related shorelands. This paper was a compilation of hydrogeologic data for numerous lakes in North America and presented a preliminary classification leads to systematic categorization of lake types for planning and management purposes. The main hydrogeologic factors for assessing lake environments are: (1) regime dominance, the relative magnitude of groundwater in the total water budget of a lake; (2) system efficiency, a description of the rate aspects of surface and groundwater movement through a lake system; and (3) position within a groundwater flow system. The significance and difficulty of measuring these descriptive characteristics were indicated, and examples of each category were provided. Additionally, a variety of lake-related activities that illustrate the value of hydrogeologic information for planning and management purposes was presented. (Visocky-ISWS)
W80-02895

PHOSPHORUS INPUTS INTO A STREAM DRAINING AN AGRICULTURAL WATERSHED, II: AMOUNTS CONTRIBUTED AND RELATIVE SIGNIFICANCE OF RUNOFF TYPES,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W80-02900

2B. Precipitation

THE ECONOMIC EFFECTS OF WEATHER MODIFICATION ACTIVITIES, PART III -- IRRIGATED AND DRYLAND AGRICULTURE WITH ESTIMATES OF PRODUCTION, EMPLOYMENT, AND INCOME EFFECTS ON THE AREA ECONOMY,
Texas Dept. of Water Resources, Austin. Planning and Development Div.
M. Kengla, R. Morey, J. Hull, and H. W. Grubb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118904, Price codes: A04 in paper copy, A01 in microfiche. Report No LP-21, August 1979. 63 p, 3 Fig, 17 Tab, 22 Ref, 2 Append.

Descriptors: *Weather modification, *Irrigated land, *Precipitation(Atmospheric), *Economic impact, Groundwater recharge, Agriculture, Texas, Income analysis, Employment, Dry farming, Rainfall, Cloud seeding, Input-output analysis meteorology.

As part of the 'High Plains Cooperative Experiment' (HIPLEX) a 14 county area of Texas, the Big Spring-Synder area, was studied to determine the economic effects of increased rainfall on the area. Precipitation in the area varys from about 14 to 22 inches annually. Approximately 90% of the area is used for crops and livestock and of this area 8.5% is irrigated. Economic effects investigated were the potential savings in irrigation water used, irrigation cost reduction, and increased farm income. A rainfall increase of 10% during the growing season, April to October, was used to determine the benefits. Historical rainfall data recorded from 1940-1970 were used as the base for deriving values for the 10% increase. An input output model was used to estimate related non-farm economic effects. Results indicate that the 10% rainfall increase would replace 22,800 acre feet of groundwater that is currently being pumped out for irrigation and this in turn would result in a $574,200 annual savings in irrigation costs. This savings in irrigation costs would mean a $370,000 annual increase in regional income and an overall $3.9 million expansion of the areas output. A $2.3 million increase would result in personal income for the area. (Seigler-IPA)
W80-02730

CONVECTIVE RAINFALL ESTIMATION FROM DIGITAL GOES-1 INFRARED DATA,
Texas A and M Univ., College Station.
G. L. Sickler, and A. H. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as N79-31885, Price codes: A05 in paper copy, A01 in microfiche. NASA Reference Publication 1034, September 1979. 94 p, 32 Fig, 5 Tab, 29 Ref, 2 Append.

Descriptors: *Rainfall intensity, *Convection, *Meteorological data, *Satellites(Artificial), Synoptic analysis, Infrared radiation, Texas, Clouds, Cloud physics, Digital computers, Rain gages, Rainfall, Meteorology, GOES-1.

Estimated corrective rainfall amounts from digital GOES-1 (Geostationary Operational Environmental Satellite) infrared data are compared to actual raingauge measured rainfall amounts. GOES-1, a meteorological satellite, is positioned 35,800 Km above the equator and maintains a position perpendicular to the earth's equatorial plane. Onboard is a visible infrared spin-scan radiometer that maps clouds in the upper atmosphere. The study area used was a 240 Km sq area in Texas. Digital GOES-1 data were obtained from Man Computer Interactive Data Access System (McIDAS) nine-track tapes at the University of Wisconsin. Some rawinsonde and synoptic data were also used. Raingauge groundtruth data were obtained from the National Climate Center publication for May 1978 in hourly segments. These data are supplemented by National Weather Service radar summaries and digital radar information. Results show a 0.92 correlation between observed and convective rainfall amounts. Overall the results demonstrate that digital geostationary infrared satellite data is a usefully accurate tool for the estimation of convective rainfall amounts. (Seigler-IPA)
W80-02739

MALVERN URBAN TEST CATCHMENT VOLUME 11,
Canada Centre for Inland Waters, Burlington (Ontario).
J. Marsalek.
Available from Training and Technology Transfer Division (Water), Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada, K1A 1C8. Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No 95, 1979. 66 p, 10 Fig, 11 Tab, 8 Ref, 1 App. 73-3-12.

Descriptors: *Watersheds(Basins), *Rainfall, *Runoff, Water quality, Hydrology, Hydrographs, Instrumentation, Data collections, Model studies, Monitoring, Burlington, Ontario.

The monitoring of rainfall-runoff events in the Malvern urban catchment was continued during 1974. A large number of rainfall-runoff events were recorded. Seventeen rainfall-runoff events were selected for further study and fairly accurately reproduced by means of the U.S. Environmental Protection Agency's Storm Water Management Model. Lake in the field season, monitoring of runoff quality was initiated. Only several runoff pollutographs were successfully recorded. These pollutographs were used to study the feasibility of simulating runoff quality in the Malvern catchment. (WATDOC)
W80-02844

METHODS OF COMPARING ANNUAL RAINFALL RECORDS FOR CLIMATIC PURPOSES,
University of East Anglia, Norwich (England). Climatic Research Unit.
J. M. Craddock.
Weather, Vol 34, No 9, p 332-346, September 1979. 6 Fig, 3 Tab, 7 Ref.

Descriptors: *Rainfall, *Climatology, *Basic data collections, *Analysis, Analytical techniques, Statistical methods, Estimating, Baseline studies, Graphical analysis, Foreign research, *England, Annual rainfall, Record extension.

This investigation sought to determine how a rainfall record made at one site could be used to extend the record at another, a problem which arises repeatedly in any serious attempt to describe the British climatic history of the last 250 years. If once it can be established how far afield it is profitable to go, then evidence from all the stations within the limiting radius can be combined to estimate for the wanted site. Five methods applied to each of 27 sets of data to produce statistics which help to describe the nature of the relationship included the method of annual ratios, methods of double-mass graphs and cumulative deviations, exponential smoothing of the conversion ratio, and the method of mixed adjustment. The methods described were applied to pairs of annual rainfall records from stations separated by distances ranging from a few feet up to 300 miles and mostly covering periods of 43 years. In not one of the 27 experiments did the results encourage the supposition that the ratio of the annual catches shows only random departures from a mean value. The method of cumulative deviations is an effective tool for comparing records for past years, but the fact that a separate graph has to be plotted for each comparison limits the extent to which it can be applied. The method of mixed adjustment provides an objective means of identifying phase changes in the past and of identifying changes within a year or two of their occurrence. (Humphreys-ISWS)
W80-02867

SPATIAL AND TEMPORAL CORRELATION OF PRECIPITATION IN ILLINOIS,
Illinois State Water Survey, Urbana.
F. A. Huff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-137706, Price codes: A02 in paper copy, A01 in microfiche. ISWS Circular 141, 1979. 14 p, 6 Fig, 6 Tab, 6 Ref.

Descriptors: *Precipitation(Atmospheric), *Illinois, *Distribution, *Rainfall disposition, Analysis, Correlation analysis, Spatial distribution, Temporal distribution, Storms, Seasonal, Annual, Sampling, Networks, Data collections.

Analysis were made of the correlation patterns of annual, seasonal, monthly, storm, and partial storm precipitation in Illinois, with major emphasis on the warm season months of May-September when convective rainfall dominates and spatial variability maximizes. Data were from the climatic network of the National Weather Service in the annual analysis, and that from dense raingage networks of the State Water Survey in the seasonal, monthly, and storm analysis. Results provide knowledge and basic information concerning the spatial and temporal distribution characteristics of precipitation. This is needed in various endeavors, such as hydrologic studies, weather modification experiments, and agricultural research in which precipitation sampling to meet certain standards of accuracy is pertinent to the success of the project. (Humphreys-ISWS)
W80-02882

RAINFALL CHANGES IN SUMMER CAUSED BY ST. LOUIS,
Illinois State Water Survey, Urbana.
S. A. Changnon, Jr.
Science, Vol 205, No 4404, p 402-404, July 27, 1979. 1 Fig, 1 Tab, 17 Ref. NSF ENV-77-15375.

Descriptors: *Rainfall, *Cities, *Distribution patterns, *Summer, Statistics, Statistical methods, Winds, Storms, Weather, Precipitation(Atmospheric), Effects, Meteorology, *St. Louis(MO).

Precipitation in and around St. Louis was investigated to study urban influences on summer precipitation conditions. Prerain winds were used to define the 'downwind area' where influences would be greatest, and wind-sorted rains were combined into monthly and summer totals. Of the 16 rain patterns, 75% revealed a rainfall maximization downwind of the city, and the rainfall in the downwind area was 22.7% more than the rainfall upwind of St. Louis where no urban influences existed. Various statistical tests of the summer rain-

fall distribution revealed the downwind rainfall to be significantly greater than elsewhere and supportive of other findings that St. Louis increases rainfall. (Sims-ISWS)
W80-02884

THE RELATIONSHIP BETWEEN ANNUAL RAINFALL AND PAN EVAPORATION IN AUSTRALIA,
State Electricity Commission of Victoria, Melbourne (Australia).
For primary bibliographic entry see Field 2D.
W80-02885

A METHOD FOR MODELING THE DEPOSITION OF SULFUR BY PRECIPITATION OVER REGIONAL SCALES,
Argonne National Lab., IL. Atmospheric Physics Section.
For primary bibliographic entry see Field 5B.
W80-02886

ERROR ANALYSIS APPLIED TO INDIRECT METHODS FOR PRECIPITATION ACIDITY,
California Inst. of Tech., Pasadena. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 2K.
W80-02887

TEMPORAL FLUCTUATIONS OF SEASONAL PRECIPITATION IN JERUSALEM,
Ben Gurion Univ. of the Negev, Beersheba (Israel). Inst. of Desert Research.
A. Zangvil.
Tellus, Vol 31, No 5, p 413-420, October 1979. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Precipitation(Atmospheric), *Seasonal, *Time series analysis, Temporal distribution, Analytical techniques, Annual, Data collections, Rainfall, Data processing, Fluctuations, Variability, Climatology, *Israel, *Jerusalem(Israel).

The annual rainfall in Jerusalem during the period 1846-47 to 1953-54 was studied by the method of time spectrum analysis and filtering techniques. The effect of different methods of spectral presentations was then demonstrated. A prominent significant peak appears in the spectrum at a period of 3.0-3.3 years, and a secondary peak is evident at 2.15 years. More than 55% of the total variance of annual rainfall in Jerusalem is concentrated in the period band between 2 and 4.3 years. The above two peaks were compared with published spectra of rainfall and other meteorological parameters in other parts of the world and were found to be compatible with the Southern Oscillation and the Quasi Biennial Oscillation, respectively. When the data were subdivided into two equal subperiods, the 3.0-3.3 years' peak remained the dominant feature in both spectra, whereas the 2.15 years' peak disappeared altogether in the second subperiod. The implications of this behavior were discussed. (Sims-ISWS)
W80-02888

NILE RIVER DISCHARGE,
National Center for Atmospheric Research, Boulder, CO.
H. Riehl, M. El-Bakry, and J. Meitin.
Monthly Weather Review, Vol 107, No 11, p 1546-1553, November 1979. 4 Fig, 3 Tab, 13 Ref.

Descriptors: *Rivers, *Discharge(Water), *Precipitation(Atmospheric), *Climatology, *Africa, Streamflow, Watersheds(Basins), Runoff, Climates, Climatic data, Rainfall, Remote sensing, Satellites(Artificial), Meteorology, *Nile River, *Aswan(Egypt), *Cairo(Egypt), *Egypt.

Based on 106 years of measured streamflow of the Nile River above Aswan, Egypt, and on readings of the annual high river flow at Cairo from the year 1700, the question of possible short-period climate changes in the source region for the water was examined. The problem of random time series was discussed; the runoff record of the Colorado River was considered in comparison. A 115-year cycle from 1725 to 1840 was compared with the still continuing subsequent regime of high flow followed by low flow. The difference between high- and low-flow periods was near 25% of average in both cases, representing a large change in available water supply. Mean annual discharge was measured as 91 cu km/yr from 1870 to 1976 and was estimated as slightly less, 87 cu km/yr, for 1725-1840, due to lower computed annual discharge in about half of the years with high flow. Variability in Nile discharge is thought to be mainly related to changes in precipitation over the Ethiopian mountains. Preliminary analysis of satellite radiation temperatures for June-September 1974 showed a marked diurnal regime with low radiation temperatures concentrated in the late part of the day. However, there are periods from 1 to 8 days with suppressed diurnal variation. Five such periods account for half of the days when radiation temperature of -30C or lower, indicative of substantial cumulonimbus presence, prevailed both day and night, mainly clustered around the high mountains. Suggestions for future research evolved from these observations. (Sims-ISWS)
W80-02901

THE DIURNAL VARIABILITY OF FLORIDA RAINFALL,
State Univ. of New York at Albany. Dept. of Atmospheric Science.
B. E. Schwartz, and L. F. Bosart.
Monthly Weather Review, Vol 107, No 11, p 1535-1545, November 1979. 14 Fig, 2 Tab, 15 Ref, NSF ATM 75-1968A01, ATM78-00531.

Descriptors: *Rainfall, *Variability, *Diurnal, *Florida, Precipitation(Atmospheric), Data processing, Analytical techniques, Climatic data, Seasonal, Storms, Weather, Climatology, Harmonic analysis.

The diurnal variation of precipitation over the Florida peninsula was investigated on the basis of harmonic analysis of hourly rainfall data. Hourly data on the frequency of three categories of precipitation events for around 70 stations in Florida were processed, generating statistics of amplitude and phase of the diurnal precipitation cycle at each station. Results were shown for all stations for the seasonal totals and for a selected cross section of stations for the detailed monthly totals. During the winter months, a small morning maximum occurs in the northwest, shifting abruptly to early afternoon across the northern panhandle. Most of the state during the remainder of the year depicts afternoon maxima. Interesting exceptions occur in the northwest and the Keys. The amplitude of the afternoon maximum decreases toward coastal areas, suggesting that nocturnal rainfall decreases the relative importance of the afternoon maximum at these locations. It was suggested that the character of the harmonic analysis for individual locations is related to probable effects of the location of the sea breeze convergence zone and the influence of extra-tropical disturbances such as quasi-stationary fronts. The large-scale flow is decisive to the timing and onset of precipitation, a fact that emerges even in the absence of wind stratification of the data. Most locations throughout the state do not show any significant semi-diurnal character in their data, and results for the diurnal precipitation cycle remain relatively consistent through all categories of precipitation. (Sims-ISWS)
W80-02902

A MODEL FOR OROGRAPHIC PRECIPITATION IN THE NORTH-CENTRAL GREAT BASIN,
Nevada Univ., Reno. Dept. of Geography.
J. G. Houghton.
Monthly Weather Review, Vol 107, No 11, p 1462-1475, November 1979. 9 Fig, 2 Tab, 18 Ref, 3 Append.

Descriptors: *Precipitation(Atmospheric), *Orography, *Great Basin, Mountains, Effects, Data processing, Regression analysis, Rainfall, Snowfall, Air circulation, Moisture, Cloud physics, Meteorology, Orographic precipitation.

The orographic effect, measured as the ratio of mountain to valley precipitation at 72 pairs of stations in the north-central Great Basin, was tested against 29 relief, location, and synoptic parameters. Parameters found significant were then subjected to stepwise multiple regression to develop equations explaining the spatial variation of precipitation for each calendar month, two synoptic seasons, and the year. The monthly and seasonal equations explained 52-83% of spatial variance and the annual equation explained 65%. They showed that the ratio increased with station elevation difference and in winter with proximity to the Pacific Ocean; significant relationships also occurred with station pair orientation, and in summer with ocean direction and Pacific storm rainfall. Best results were obtained either for pairs with long-term records or those with both stations topographically close together. An equation using mean monthly Great Basin wind speed and Pacific storm rainfall explained 88% of the annual variation in the Basin mean monthly orographic ratio. (Sims-ISWS)
W80-02903

2C. Snow, Ice, and Frost

REGIONAL PATTERNS OF CONTAMINANTS (PAH, PESTICIDES AND TRACE METALS) IN SNOW OF NORTHEAST BAVARIA AND THEIR RELATIONSHIP TO HUMAN INFLUENCE AND OROGRAPHIC EFFECTS,
Bayreuth Univ. (Germany, F.R.). Lehrsteuhl fuer Hydrologie.
For primary bibliographic entry see Field 5B.
W80-02896

2D. Evaporation and Transpiration

THE RELATIONSHIP BETWEEN ANNUAL RAINFALL AND PAN EVAPORATION IN AUSTRALIA,
State Electricity Commission of Victoria, Melbourne (Australia).
R. D. Hoy.
Australian Meteorological Magazine, Vol 26, No 2, p 45-54, June 1978. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Evaporation, *Rainfall, *Precipitation(Atmospheric), *Australia, Regression analysis, Meteorology, Hydrology, Climates, Climatology, Evaporation pans, *Annual rainfall, Regression line, Rainfall variation, Surface moisture.

Annual totals of pan evaporation and rainfall are shown to be inversely correlated over much of inland Australia. The slope of the regression line is most negative in the interior of the continent and becomes less negative or zero near the coast. Over much of inland Australia, the year-to-year variation in pan evaporation is greater than the corresponding rainfall variation. The relationships found may be used to determine the annual pan evaporation associated with annual rainfall totals. (Roberts-ISWS)
W80-02885

EVAPOTRANSPIRATION UNDER DEPLETING SOIL MOISTURE,
Kasetsart Univ., Bangkok (Thailand).
W. Boonyatharokul, and W. R. Walker.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR4, Proceedings Paper 15018, p 391-402, December 1979. 7 Fig, 1 Tab, 10 Ref, 2 Append, EPA R-804827.

Descriptors: *Evapotranspiration, *Irrigation practices, *Soil moisture, *Model studies, *Colorado, Mathematical models, On-site investigations, Lysimeters, Irrigation, Irrigation efficiency, Scheduling, Crops, Alfalfa, Moisture deficit, Farm management.

Data from two hydraulic weighing lysimeters planted to alfalfa were used to calibrate a simplified root extraction sink term in a model of the one-dimensional continuity equation. The model was then utilized to generate the expected response of alfalfa to depleting soil moisture levels for a

wide range of possible soil and atmospheric conditions. This information led to the calculation of values for the K sub s stress coefficient employed in irrigation scheduling programs. A new relationship describing the reductions in evapotranspiration as the soil moisture reservoir is depleted was formulated. The calibration data were also employed to evaluate the commonly used logarithmic and linear soil moisture stress models. The results indicated that both models reasonably predicted measured data until the available soil moisture in the root zone diminished below about 50%. (Sims-ISWS)
W80-02909

2E. Streamflow and Runoff

FLOOD HAZARD STUDY -- MARLBOROUGH, NEW HAMPSHIRE: MINNEWAWA BROOK, ROBBINS BROOK, AND SOUTH BRANCH ASHUELOT RIVER.
Soil Conservation Service, Durham, NH.
In cooperation with the NH Office of Comprehensive Planning and the Town of Marlborough, March 1979. 44 p, 18 Fig, 5 Tab, 11 Ref, 10 Append.

Descriptors: *Flood profiles, *Flood plains, *New Hampshire, *Flood control, Dams, Flow control, Water management(Applied), Ice jams, Melting, Snow cover, Channel flow, Watershed management, Hydroelectric plants, Water levels.

Sections of three streams in Marlborough, New Hampshire, were studied to promote public awareness of flood plain areas and to devise a flood plain management plan. The town has predominantly fast flowing streams with narrow flood plains. Much development has occurred at the wider places along the flood plains. Historically, flooding has occurred in all seasons with major floods in 1818, 1826, 1927, 1936, 1938, 1959, and 1976. Causes of flooding include heavy rains, melting snow, hurricanes, and ice jams with ice jams causing the major problems. Route 12, Route 101, and many smaller streets are inundated during a 100-year or larger flood. Until 1968 the Public Service Company operated a dam above the town for electric power production. When generation stopped several changes occurred that have increased ice jam problems including the removal of a control conduit, increased flood plain development, and narrowing of channels. Also the old dam is rapidly deteriorating and should it be removed future flood potential would be greatly increased. Flood hazard area photomaps and profiles are presented along with a flood plain management plan for the area. Photographs showing the depth of flooding likely to occur at various points are also provided. (Seigler-IPA)
W80-02729

FACTORS INFLUENCING THE LOW PHYTOPLANKTON STANDING CROP IN SUISUN BAY DURING THE 1976-1977 DROUGHT,
Bureau of Reclamation Sacramento, CA.
J. F. Arthur, and M. D. Ball.
Report 1979. 93 p, 32 Fig, 7 Tab, 16 Ref.

Descriptors: *Phytoplankton, *California, *Droughts, *Low flow, Discharge(Water), Benthic fauna, Aquatic algae, Eutrophication, Estuaries, Bays, Trap efficiency, Light penetration, Nutrients, Salinity, Zooplankton, Toxins, Deltas, Parasitism, Water temperature.

During the record dry consecutive years 1976 and 1977, the standing crop of phytoplankton in the Suisun Bay, California, declined rather than increasing as it had done during previous dry periods. Field and laboratory studies of low river discharge into the San Francisco Bay-Delta Estuary and related factors were conducted to determine the cause(s) for the low p hytoplankton occurrence. Nine factors were evaluated as possible causes: (1) available light as factors of solar radiation and water transparency, (2) water temperatures, (3) nutrients, (4) toxicity, (5) parasitism, (6) high salinity, (7) zooplankton grazing, (8) benthic filter feeding, and (9) entrapment zone location relative to shallow bays. In general, measurements of these factors during the dry years were compared to values from previous years. All factors except benthic filter feeding and entrapment zone location were eliminated as probable causes. Although the low Delta outflow conditions of the drought caused a benthic organism influx, indirect evidence indicates that the influx did not cause the low phytoplankton standing crop. Evidence does indicate that the movement of the entrapment zone from the channel and shallow production waters of the Suisun Bay into the Sacramento and San Joaquin River system was probably the cause for the phytoplankton decrease. (Seigler-IPA)
W80-02741

A MODEL FOR WATER CIRCULATION AND SOLUTE TRANSPORT IN POOL NO. 2 OF THE MISSISSIPPI RIVER,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
H. Stefan, and A. Demetracopoulos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134695, Price codes: A06 in paper copy, A01 in microfiche. Project Report No 186, Oct 1979. 85 p. OWRT A-039-MINN(1).

Descriptors: *Mississippi River, *Water circulation, Water quality, Mathematical model, Low flow, *Mass transfer, Backwater, Locks, Dams, Minnesota.

Low flow water circulation in Pool No. 2 of the Mississippi River was analyzed and the resulting flow distribution was used for the computation of mass (solute) transport through the system. The study establishes a basis for dynamic water quality modelling at a very short time-scale as appropriate e.g. for dissolved oxygen or suspended solids. The river reach analyzed receives the effluent from the Metropolitan waste treatment plant (Pig's Eye Plant), but has also great recreation potential because of its proximity to the Twin Cities. Pool No. 2 of the Mississippi River has a fairly complex geometry. It was analyzed as a network of 17 fixed boundary segments, taking into account gravity forces, bad shear stresses, local (minor) energy losses and wind effects. The hydrodynamic equations were solved for quasi-steady state conditions. A 6-hour time interval was used, and the validity of this choice was verified by a transient response analysis of the system. The mass transport was analyzed with a cells-in-series type model. Division of the fixed boundary segments into a variable number of sub-segments was used to account for the observed dispersion. Good agreement was found between computed time-concentration curves and three sets of measured dye concentrations. The hydrodynamic and transport model described herein is the basis for a water quality model now under development. (Blake-Minn)
W80-02763

WETLANDS AND ORGANIC SOILS FOR THE CONTROL OF URBAN STORMWATER,
Hickok (Eugene A.) and Associates, Wayzata, MN.
E. A. Hickok.
In: Lake Restoration, Report No EPA 440/5-79-001, p 153-158, 1979. 3 Fig, 6 Tab.

Descriptors: *Storm runoff, *Watersheds(Basins), *Urban runoff, *Organic soils, Phosphorus, Minnesota, Wetlands, Adsorption, Organic matter, Soils, Waste assimilative capacity, Marshes, Water treatment, Eutrophication, Sediment control.

A seven-acre wetland in the Minnehaha Creek Watershed District, Minnesota, was studied during 1974 through 1975 to determine its effect on stormwater runs. Influent and effluent water sources and amounts were monitored to develop water and nutrient balances. Instrumentation used includes 5 parshall flumes, 13 polyvinyl chloride observation wells, and a complete weather observation station. Physical entrapment, microbial utilization, plant uptake, and adsorption were all found to be active mechanisms in the wetland system. The phosphorus adsorptive capacity of the area indicated that the organic soils of the watershed contain between 5 and 17 times the amount of phosphorus expected. Application of study results led to the development of five projects: (1) extensive environmental planning and construction was done for the building of a new shopping center in the study area; (2) a biologically activated soil filtration unit was constructed to filter phosphorus from the hypolimnion water of Wirth Lake in Minneapolis; (3) an oil retention basin, a six-acre wetland treatment area, and a filter dyke for drawdown were developed for a watershed at the Minneapolis St. Paul airport; (4) a marsh is being utilized by Annandale, Minnesota, to treat combined urban runoff and treated wastewater; and (5) organic soils and wetlands are being used for the Long Lake Restoration Project. (See also W80-02773) (Seigler-IPA)
W80-02797

FLOOD LOSSES: WHY CAN'T WE ANSWER EVERYONE'S QUESTIONS,
Office of the Chief Engineer (Army), Washington, DC.
G. R. Phippen.
In: Natural Hazards Data Resources: Uses and Needs; Program on Technology, Environment and Man, Monograph 27; Institute of Behavioral Science, Colorado University p 73-79 1979. 1 Fig, 1 Tab.

Descriptors: *Flood data, *Flood damage, *Data collections, Hydrologic data, Federal government, Flood protection, Historic floods, Flood plain insurance, Maximum probable flood, Design floods, Water policy, Statistics.

While it is generally agreed that a systematic, universal flood loss record is needed it would be quite expensive and it is therefore unlikely that such a record will be developed. Most flood loss data to date is site-specific with a large vocabulary that is tailored for user needs rather than general reader needs and many flood-loss terms are often misused. Data users include planners, builders, engineers, program managers, researchers, insurers, and politicians. Because of this wide variety of users many kinds of information are needed. Many recommendations for a national systematic flood-loss data acquisition and analysis have been made but funding would have to come from other water resources agency programs. To date the agencies have been unwilling to commit the necessary funds as they feel that they can get by without the program. Some flood-loss information is assembled by the National Weather Service and by the National Assessment of flood losses provided by the U. S. Water Resources Council. Conditions for a hypothetical river reach using theses data sources are illustrated. A basic weakness of much flood loss data is the inability to draw reasonable conclusions from the comparison of average yearly losses and average annual losses. (Seigler-IPA)
W80-02807

SPECIAL FLOOD HAZARD INFORMATION: WOLF CREEK, GRANADA, COLORADO.
Army Engineer District, Albuquerque, NM
Prepared for City of Granada, Colorado, April 1974. 26 p, 5 Fig, 5 Plates, 4 Tab.

Descriptors: *Colorado, *Floods, *Flooding, *Indirect flood measurement, *Flood profiles, *Storms, *Cloudbursts, *Historic floods, *Rivers, *Floodways, *Flood protection, *Control structures, *Levee, *Wolf Creek(CO), *Granada(CO), River flow, Streamflow forecasting, Flood forecasting, Design flood, Flood stages, Peak discharge, Flood peak, Flood damage, Flood plain management, Standard Project Flood, Intermediate Regional Flood.

This report presents information on the flood hazard caused by Wolf Creek in the vicinity of Granada, Colorado. Wolf Creek is a tributary of the Arkansas River and has a drainage area of 122 square miles. The drainage area is almost exclusively agricultural. Stream gage records are not available but reports indicate that flooding occurred in 1918, and more recently in 1965 (the largest flood) and 1972. The estimated peak discharge for the 1965 flood is 35,300 cubic feet per second (cfs). Flooding is caused by intense rainfall

resulting from thunderstorms and cloudbursts. Minimal flood protection exists from a levee around the west and north sections of Granada. Obstructions to floodflow consist of bridges, embankments and natural vegetation. The Standard Project Flood would have a peak discharge of 41,000 cfs, with a main channel velocity of 4 feet per second. The Intermediate Regional Flood would have a peak discharge of 27,000 cfs, with a main channel velocity of 3 feet per second. The report contains flood characteristics for the SPF and IRF if there was a flood control project; this would not affect the peak discharge but would lessen the height of rise above bankfull by more than one foot and increase main channel velocities to 8 and 7 feet per second, respectively, for the SPF and IRF. Guidelines for floodplain management are presented. (Iervolino-NC)
W80-02848

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER & TRIBUTARIES, GREAT BEND, KANSAS.
Army Engineer District, Albuquerque, NM.
Prepared for Great Bend, Kansas, April 1976. 33 p, 7 Fig, 12 Plates, 5 Tab.

Descriptors: *Kansas, *Floods, *Flooding, *Flood flow, *Indirect flood measurement, *Design flood, *Flood profiles, *Flood stages, *Peak discharge, *Arkansas River(KS), *Walnut Creek(KS), *Great Bend(KS), Storms, Hurricanes, Historic floods, Flood data, Flood peak, Rivers, Floodways, Flood plains, Standard Project Flood, Flood protection, Control structures, Levee, Dams, Channel improvement, 100-year flood.

The report presents information on the flood hazard areas of the Arkansas Rivers and tributaries in Great Bend, Kansas and vicinity. The drainage area of the Arkansas River study area is 11,796 square miles, and 1,717 square miles for its tributary, Walnut Creek. Almost the entire city of Great Bend is located within the flood plains; development includes residential, commercial, public facilities and utilities. The first recorded flood on the Arkansas River occurred on July 23, 1895. More recent floods occurred in 1951, 1958, and 1965. Data were obtained from the U.S. Geological Survey and historical records. Major flooding occurs during May through September and is caused by long duration rainfall or thunderstorms. Obstructions to flood flows include bridges, embankments and natural vegetation. The John Martin Dam which spans the Arkansas River 286 miles upstream from Great Bend was constructed for flood control and will control floods up to and including the Standard Project Flood. Other flood control measures include local levee construction and channel improvements. A public river and flood forecasting service is provided for all the Arkansas River Bend, including Great Bend. The largest recorded flood occurred in June 1965, discharging 27,800 cubic feet per second (cfs) at Great Bend. At the same location the Standard Project Flood (SPF) would discharge 76,000 cfs while the 100-year flood would discharge 42,000 cfs. On Walnut Creek the SPF and 100-year floods would discharge 69,000 cfs and 27,200 cfs, respectively. This report furnishes a suitable basis for adoption of land use controls to guide flood plain development. (Iervolino-NC)
W80-02849

SPECIAL FLOOD HAZARD INFORMATION: CLEARWATER CREEK, RICE CREEK WATERSHED, CENTERVILLE, LINO LAKES, HUGO, MINNESOTA.
Army Engineer District, St. Paul, MN.
Prepared for Rice Creek Watershed District, June 1975. 50 p, 15 Fig, 13 Plates, 7 Tab.

Descriptors: *Minnesota, *Floods, *Flooding, *Flood flow, *Indirect flood measurement, *Flood profiles, *Design flood, *Storms, *Flood protection, *Clearwater Creek(MN), *Centerville(MN), *Lino Lakes(MN), *Amoka County(MN), *Washington County(MN), *Hugo(MN), Flood forecasting, Historic floods, Flood stages, Peak discharge, Flood peak, Rivers, Floodways, Flood plains, Flood plain management, Standard Project Flood, Non-structural alternatives, Flood plain zoning, Land use, Planning, Zoning, Control structures, Dikes, Intermediate Regional Flood.

The study area covers the flood plain for Clearwater Creek in the vicinity of the Cities of Hugo, Lino Lakes and Centerville, Minnesota. The area included in this study is located along the Creek from the outlet of Bald Eagle Lake to the mouth at Peltier Lake and includes two branches which are tributary to the main stem. The drainage area of this section of Clearwater Creek is 62 square miles. The major portion of the study area is either developed for agricultural purposes or is undeveloped open space. Major flooding can be expected to occur during the summer months as a result of high intensity rainfall. Snowmelt runoff combined with spring rains can also produce major flooding. Obstructions to floodflow are natural and manmade. Records and other documentation concerning past floods are not available; the history of flooding is from personal accounts of nearby residents. For the Intermediate Regional Flood the peak discharge would range from 150 cubic feet per second (cfs) to 1780 cfs, with flood elevations ranging from 905 to 913 feet above sea level. For the Standard Project Flood the peak discharges would range from 520 cfs to 4380 cfs, with flood elevations ranging from 194.7 to 914 feet above sea level. The control structure for Bald Eagle Lake and the drainage ditch improvements are the only structural flood control measures in the study area. Special zoning districts have been adopted by the City of Hugo for lakeshore and flood hazard areas. Water resource management planning in the study area has generally been limited to the planning accomplished by the Rice Creek Watershed District. Flood plain management techniques are discussed. This report is intended to provide knowledge of flood potential and hazards for land use planning. (Iervolino-NC)
W80-02850

SPECIAL FLOOD HAZARD INFORMATION: GYPSUM AND DRY CREEKS, WICHITA, KANSAS.
Army Engineer District, Tulsa, OK.
Prepared for City of Wichita, KS, January 1976. 18 p, 4 Fig, 14 Plates, 3 Tab.

Descriptors: *Kansas, *Floods, *Flooding, *Flood flow, *Indirect flood measurement, *Wichita(KS), *Gypsum Creek(KS), *Dry Creek(KS), Flash flood, River forecasting, Flood forecasting, Design flood, Storms, Thunderstorms, Historic floods, Flood data, Flood stages, Peak discharge, Flood peak, Flood damage, Rivers, Floodways, Flood plain management, Standard Project Flood, Flood protection, Warning systems, Intermediate Regional Flood.

The study area is the flood plains of Gypsum Creek and Dry Creek at Wichita, Kansas. The drainage area for Gypsum Creek is 22 square miles and 4.2 square miles for Dry Creek. Gypsum Creek has a slope of 11 feet per mile and Dry Creek descends at 19.5 feet per mile. Urban development covers 35% of the Gypsum Creek Watershed and 90% of the Dry Creek Watershed. Flooding occurs from May until September and is caused by intense thunderstorms. Obstructions to the floodflow are caused by bridges, culverts, shrubbery and debris. The record flood occurred on August 24, 1960 and caused about 8 feet of flooding near the confluence of Gypsum and Dry Creeks. Other floods occurred in 1959, 1963 and 1964. For the Intermediate Regional Flood the peak flow of Gypsum Creek would be 9,900 cubic feet per second (cfs) and for Dry Creek it would be 4,100 cfs. The Standard Project Flood would discharge 19,250 cfs on Gypsum Creek and 6,800 cfs on Dry Creek. The National Weather Service in cooperation with the City of Wichita has plans for the establishment of a Flash Flood Warning Program for Gypsum and Dry Creeks Basins. The program will include rain gage and staff river gage stations within the basins with a flash alarm gage to be installed. Guidelines for flood plain management are presented. (Iervolino-NC)
W80-02851

SPECIAL FLOOD HAZARD INFORMATION REPORT: SANDY LICK CREEK, CITY OF DUBOIS, CLEARFIELD COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
Prepared for The City of Dubois and the Commonwealth of Pennsylvania, Dept. of Environmental Resources, June 1975. 4 p, 3 Plates, 2 Tab.

Descriptors: *Pennsylvania, *Floods, *Flooding, *Flood flow, *Flood stages, *Dubois(PA), *Sandy Lick Creek(PA), *Clearfield County(PA), Indirect flood measurement, Flood forecasting, Design flood, Flood profiles, Historic floods, Peak discharge, Rivers, Floodways, Flood plains, Flood protection, Control structures, Channel improvement, 100-year flood, 500-year flood.

The study area is the floodplain for Sandy Lick Creek in the vicinity of the City of Dubois in Clearfield County, PA. Studied is a 4.66 mile stretch of the creek which has a total drainage area of 231 square miles. Sandy Lick Creek has several tributaries within the study reach, the two main ones being Wolf Run and Laborde Branch. These two have a combined drainage area of 42.1 square miles. The main channel slope of Sandy Lick Creek varies from 3.5 feet per mile for most of its length to about 600 feet per mile in the upper extremities. Development within the flood plain consists of roads, education and recreational facilities, business and commercial structures and some scattered residences. At the time of the report a flood control project on Sandy Lick Creek and Beaver Run was under construction. The project consists of approximately 25,000 lineal feet of channel improvement and was expected to be completed by late 1976. The highest known flood occurred in 1972 reaching an elevation of 1,399 feet above mean sea level (msl); other recent floods have occurred in 1964 and 1967. The 100-year flood would reach an elevation of 1398.9 feet msl with a peak discharge of 4,500 cubic feet per second (cfs). The 500-year flood would reach an elevation of 1402.6 feet msl and have a peak discharge of 7,200 cfs. The report is intended to provide a basis for further study to plan for the solution of flood problems. (Iervolino-NC)
W80-02852

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER, ANDERSON AND KING ARROYOS, LA JUNTA, OTERO COUNTY, CO.
Army Engineer District, Albuquerque, NM.
Prepared for City of La Junta, Colorado and Otero County, August 1977. 29 p, 28 Plates, 4 Tab.

Descriptors: *Colorado, *Floods, *Runoff, *Flooding, *Surface runoff, *Indirect flood measurement, *Design flood, *Flood profiles, *Storms, *Historic floods, *Flood stages, *Peak discharge, *Flood peak, *Arkansas River(CO), *King Arroyo(CO), *Anderson Arroyo(CO), *La Junta(CO), *Otero County(CO), Maximum probable flood, Flood forecasting, Flood data, Flood damage, Erosion, Rivers, Floodways, Flood plains, Standard Project Flood, Flood protection, Control structures, Levee, Channel improvement, Intermediate Regional Flood.

This report presents information on the flood hazards at and in the vicinity of La Junta, Colorado caused by flooding from the Arkansas River and two of its tributaries, King Arroyo and Anderson Arroyo. In the study reach of the Arkansas River the gradient fluctuates between five and nine feet per mile, with an average of 6.7 feet per mile, with a drainage area of 12,210 square miles. Both arroyos are right bank tributaries of the Arkansas River and have a combined drainage area of 79 square miles. Developments in the flood plains include residential, commercial and industrial structures, utilities and transportation facilities. Floods in the study area are of two general types: spring floods resulting from melting snow augmented by storm runoff and summer floods resulting from storm runoff. Obstructions to floodflow consist of natural vegetation and bridges. The earliest known flood occurred in 1826; more recent major floods occurred in 1965, 1969 and 1972. For the 100-year flood the peak discharges would be 92,000 cubic feet per second (cfs), 7,500 cfs and

10,500 cfs for the Arkansas River, King Arroyo and Anderson Arroyo, respectively. For the Standard Project Flood the peak discharge on the Arkansas River would be 212,000 cfs. Levees have been constructed along the Arkansas River as a flood damage reduction measure but they are substandard. The proposed La Junta Local Protection Project consists of levee construction, channelization work, bank protective stabilization work and landside interior drainage ditches. (Iervolino-NC)
W80-02854

SPECIAL FLOOD HAZARD INFORMATION: CIBOLO CREEK, PRESIDIO & SHAFTER, TEXAS.
Army Engineer District, Albuquerque, NM.
Prepared for Presidio and Shafter, Texas, March 1976. 14 p, 17 Plates, 1 Tab.

Descriptors: *Texas, *Floods, *Flooding, *Indirect flood measurement, *Flood forecasting, *Flood profiles, *Flood stages, *Peak discharge, *Cibolo Creek(TX), *Presidio(TX), *Shafter(TX), Flood flow, River flow, Storms, Thunderstorms, Historic floods, Flood data, Flood peak, Flow duration, Stage-discharge relations, Rivers, Floodways, Flood protection, Control structures, Levee, Standard Project Flood, Presidio County(TX), Intermediate Regional Flood.

The study area is the flood plain of the Cibolo Creek in the vicinity of Presidio and Shafter in Presidio County, Texas. The Cibolo Creek is the northbank tributary to the Rio Grande and has a drainage area of 278 square miles. The slope of the creek varies from 70 to 50 feet per mile going downstream. This area, which contains residential development, commercial development, public facilities and agricultural lands, has been extensively damaged in past floods and there exist strong possibilities for possible larger floods. The maximum flood occurred in 1944 when 3,000 acres of farmland were flooded. Other floods occurred in 1904, 1917, 1932, 1958, 1965 and 1974. Data on past floods were collected from the International Boundary and Water Commission, through interviews and at a public meetings. Flooding occurs in the summer and is caused by decaying thunderstorms. Obstructions to floodflow consist of bridges, embankments, landfills, levees and natural features. At Presidio the 100-year flood would have a peak discharge of 36,000 cubic feet per second (cfs), with flood duration of 6 hours, and main channel velocity of 7.8 feet per second (fps). The Standard Project Flood at Presidio would have a peak discharge of 67,000 cfs, with a duration of 7.2 hours, and a main channel velocity of 6.5 fps. Presidio County has constructed levees to control floods but has not adopted any regulations that would control development in flood areas. (Iervolino-NC)
W80-02855

EXPANDED FLOOD PLAIN INFORMATION STUDY: ROWLETT CREEK, DALLAS AND COLLIN COUNTIES, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for Cities of Plano, Garland and Richardson, The North Central Texas COG and Texas Dept. of Water Resources. Vol I-General Report, September 1978. 48 p, 3 Fig, 4 Plates, 13 Tab.

Descriptors: *Texas, *Floods, *Flooding, *Flood damage, *Rowlett Creek(TX), *Dallas County(TX), *Collin County(TX), Historic floods, Flood stages, Peak discharge, Frail lands, Rivers, Floodways, Flood plains, Hydrological analysis, Environmental analysis, Standard project flood, Cottonwood Creek(TX), Spring Creek(TX).

The study area is the Rowlett Creek Watershed northeast of Dallas, TX. The watershed is about 137 square miles and in addition to the main stem Rowlett Creek includes two major tributaries--Cottonwood Creek and Spring Creek. Development includes residential, commercial and light industrial structures and such development is rapidly increasing. The main stem channel length of Rowlett Creek is about 31 miles with an average slope of 12 feet per mile. Moderate to large floods have occurred in the watershed in 1933, 1942, 1946, 1947, 1951, 1957, 1962, 1964 and 1977. This report employs the Expanded Flood Plain Information (XFPI) concept which is designed to examine all facets of the flooding problem with respect to existing land use development and relate those results to what could happen under varying conditions of future development. Under 1976 conditions, $200,000 damages can be expected on an average annual basis. Three different policies were developed and flood damages were calculated for future urbanization under the separate policies. Policy 1 signifies unconstrained flood plain development and it was calculated that the flood damages would increase over two hundred-fold above the 1976 condition damages (from $200,000 to $43,000,000). Policy 2 calls for adoption of 100-year flood plain regulations that would reduce flood damages from Policy 1 conditions; flood damages would increase four-fold from 1976 conditions (from $200,000 to $900,000). Policy 3 calls for adoption of 100-year Flood Plain Regulations with Floodway; average annual flood damages would be $360,000. An environmental inventory was conducted. An assessment of nonpoint source pollution was undertaken and findings indicated that pollutant loadings can be expected to increase in an almost direct relationship to urbanization. (Iervolino-NC)
W80-02856

FLOOD HAZARD INFORMATION: SAN MARCOS AND BLANCO RIVERS, SAN MARCOS, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for City of San Marcos, Texas, June 1971. 35 p, 7 Fig, 14 Plates, 4 Tab.

Descriptors: *Texas, *Floods, *Flooding, *Indirect flood measurement, *Flood profiles, *Historic floods, *San Marcos(TX), *San Marcos River(TX), *Blanco River(TX), Design flood, Surface runoff, Flood flow, River flow, Flood data, Flood stages, Peak discharge, Flood peak, Flood damage, Erosion, Frail lands, Bank erosion, Rivers, Floodways, Flood plains, Standard Project Flood, Flood plain management, Flood protection, Flood plain insurance, Intermediate Regional Flood.

The report covers the flood hazard information for the San Marcos and Blanco Rivers in the vicinity of San Marcos, Texas. Along with their tributaries--Sink, Purgatory, and Willow Springs Creeks--the two rivers have a drainage area of 1,228.8 square miles. The watershed is characterized by rugged hills, narrow valleys, thin soil cover and frequent outcroppings of rock which, combined with steep stream and valley slopes, are conducive to rapid rainfall runoff rates. This report concerns mainly the upper 5 miles of the San Marcos River. Data were obtained from U.S. Geological Survey records, local residents and field surveys. The five largest floods on the San Marcos River, in descending order of magnitude, were those of September 1921, May 1970, September 1952, 1929 and 1913. Large floods have also occurred on the Blanco River, most recently in 1970. Various plans for reducing flood stages have been formulated by the Corps of Engineers. One project started by the Corps was discontinued at the request of the San Marcos City Council in 1969. The City of San Marcos receives emergency flood insurance coverage under the National Flood Insurance Program. For the 100-year flood peak discharge on the San Marcos River would range between 40,000 to 118,000 cubic feet per second (cfs). The Standard Project Flood's peak discharge would range between 65,900 to 190,000 cfs. The main purpose of this report is to provide guidance for intelligent flood plain land use. (Iervolino-NC)
W80-02872

FLOOD PLAIN INFORMATION: MISSOURI RIVER, BISMARCK-BURLEIGH COUNTY, NORTH DAKOTA.
Army Engineer District, Omaha, NE.
Prepared for City of Bismarck and Burleigh County, August 1974. 36 p, 28 Fig, 16 Plates, 5 Tab.

Descriptors: *North Dakota, *Floods, *Runoff, *Flooding, *Surface runoff, *Flood flow, *Indirect flood measurement, *Flood forecasting, *Design flood, *Flood profiles, *Historic floods, *Flood stages, *Peak discharge, *Flood peak, *Flood protection, *Control structures, *Dams, *Reservoirs, *Bismarck(ND), *Missouri River(ND), *Burleigh County(ND), River flow, Maximum probable flood, River forecasting, Flood data, Flood damage, Rivers, Floodways, Flood plains, Ice jams, Standard Project Flood, Garrison Dam(ND), Fort Peek Dam(ND), Intermediate Regional Flood.

The study area is the 186,355 square mile drainage area of the Missouri River in the vicinity of Bismarck, Burleigh County, ND. The study reach is 41.1 miles long and the flood plain width ranges from 1900 to 1700 feet. Existing land uses in the flood plain are mainly agricultural but considerable residential and commercial development has recently taken place. Two dams were constructed to reduce the flood threat--Fort Peek Dam and Reservoir in 1938 and Garrison Dam in 1953. Annual peak flows in the study area result from discharges from the upstream dams together with storm runoff from the uncontrolled downstream area and occur from March to September. Since the completion of Garrison Dam in 1953 there has not been any flooding in the study reach. Significant floods prior to the dam completion occurred on the Missouri River as early as 1881, with the most recent flood occurring in 1952. Ice jams have contributed to some of the past floods. Obstructions to flood flow consist of natural growth and manmade structures. For the Intermediate Regional Flood peak discharge would range from 96,500 cubic feet per second (cfs) to 122,000 cfs, with flood elevations ranging from 1630.8 to 1655.1 feet mean sea level (msl). For the Standard Project Flood the peak discharge would range from 136,700 to 182,000 cfs, with flood elevation ranging from 1632.8 to 1657.4 feet msl. The report is intended to provide knowledge of flood potential and hazards as important considerations in land use planning and flood plain utilization. (Iervolino-NC)
W80-02873

ON THE ORIGIN AND CHARACTERISTICS OF RIVER CHANNEL PATTERNS,
Sheffield Univ. (England). Dept. of Landscape Architecture.
D. I. Brotherton.
Journal of Hydrology, Vol 44, No 3/4, p 211-230, December 1979. 9 Fig, 1 Tab, 15 Ref.

Descriptors: *Channels, *Channel morphology, *Rivers, Meanders, Braiding, Geomorphology, Discharge(Water), Erosion, Effects, Valleys, *Channel patterns, Secondary current, Braid channel.

A theory of the origin of channel patterns was developed and enabled predictions of relationships and characteristics which were tested. It was concluded that meanders form where the discharge erodes and transports bank particles with comparable ease, while braids characterize rivers with highly erodable banks. In both cases, the bank erosion may be induced either by deposition of input sediment (deposition meander or braid) or directly by a discharge with excess energy (erosion meander or braid). Deposition meanders form where the bank material is fine-grained relative to the deposited sediment; deposition braids where the bank material is coarse-grained or where banks are particularly incoherent and fine-grained. Erosion meanders carry a discharge which entrains bank particles in preference to bed particles and transports them downstream; erosion braids carry a discharge which transfers material from bank to bed without downstream movement. Comparisons were made between patterns, and the effects of discharge, valley slope, channel material, and the quantity and quality of sediment input were explored. The resulting predictions were tested using data from 57 natural rivers. (Lee-ISWS)
W80-02891

THE ROLE OF GROUNDWATER IN STORM RUNOFF,
Windsor Univ. (Ontario). Dept. of Geology.
M. G. Sklash, and R. N. Farvolden.

Journal of Hydrology, Vol 43, No 1/4, p 45-65, October 1979. 18 Fig, 1 Tab, 20 Ref.

Descriptors: *Storm runoff, *Groundwater, *Hydrographs, *Tracers, Snowmelt, Runoff, Groundwater movement, Isotope studies, Oxygen isotopes, Deuterium, Tritium, Watersheds(Basins), Streams, Rainfall, Base flow, Discharge(Water), Hydrology.

Groundwater plays a much more active, responsive, and significant role in the generation of storm and snowmelt runoff in streams than the recent literature on the subject suggests. Basin-wide tracer experiments using environmental isotopes (180, deuterium, tritium) and hydrometric studies carried out in hydrogeologically diverse watersheds indicate that for all except the most intense rainstorms and the most prolific melting days, groundwater dominates the runoff hydrographs in the study basins. The increased groundwater discharge during runoff events is apparently related to a rapid rise in hydraulic head along the perimeter of transient and perennial discharge areas. This groundwater ridging phenomenon probably arises from the almost instantaneous conversion of the near-surface tension-saturated capillary fringe into phreatic water. The ridging precedes, and is apparently independent of, the response of the rest of the basin. In addition to its compatibility with several of the field observations commonly associated with contemporary concepts of runoff generation, the groundwater discharge theory explains some of the temporal variations in stream water chemistry which are not adequately accounted for by other theories. (Sims-ISWS)
W80-02894

NILE RIVER DISCHARGE,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 2B.
W80-02901

DISPERSION IN ROUGH RECTANGULAR CHANNELS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
E. M. Valentine, and I. R. Wood.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY12, Proceedings Paper 15088, p 1537-1553, December 1979. 10 Fig, 1 Tab, 9 Ref, 2 Append.

Descriptors: *Boundaries(Surfaces), *Roughness(Hydraulic), *Numerical analysis, *Open channel flow, *Tracers, *Eddies, *Dispersion, Hydraulics, Mathematical models, Rivers, Turbulent flow, Solutes, Turbulence, Model studies.

A three-dimensional numerical model was developed from a two-dimensional solution reported previously by the writers. A rectangular 'smooth' laboratory flume was used to verify the model without dead zones; two series of field experiments carried out in a water race then were used to test the model for two different roughness conditions. Despite the simplifications involved in the numerical model, it provides a reasonable description of the process in the channel examined. Principally, there is a delay before the Fickian-type dispersion, and the dispersion coefficients are comparable with those found in the field. Although the theory has not reached a stage where it can be applied to most rivers, it does lend itself to the possibility of a classification system for dead zones in river channels, and it demonstrates the importance of the trapping mechanism to the dispersion process in river channels. (Adams-ISWS)
W80-02910

MATHEMATICAL MODELING OF VEGETATIVE IMPACTS FROM FLUCTUATING FLOOD POOLS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W80-02916

2F. Groundwater

GROUND-WATER GEOLOGY OF SELECTED WETLANDS IN UNION AND ALEXANDER COUNTIES, ILLINOIS,
Illinois State Geological Survey, Urbana.
E. D. McKay, A. Elzeftawy, and K. Cartwright.
Environmental Geology Notes No 85, July 1979. 46 p, 8 Fig, 10 Tab, 16 Ref, 1 Append.

Descriptors: *Mississippi River, *Wetlands, *Ditches, *Drainage, *Groundwater, Illinois, Hydrogeology, Hydrologic budget, Swamps, Piezometry, Water table, Alluvial channels, Flood plains, Flood discharge.

The hydrogeologic settings and groundwater geology of La Rue Swamp and two wetland areas in the Big Five Districts alluvial plain of the Mississippi River, Illinois, were studied. The study was conducted to determine the impact of proposed surface drainage improvements on the wetlands. In the area, the Mississippi River has cut a deep valley into Paleozoic bedrock while the valley bluffs are Lower Devonian limestones and cherts. The river channel is directly against the upland bedrock that forms the valley's western edge, while the alluvial plain spreads eastward for 6 to 10 kilometers. Field studies conducted include geologic mapping, 37 geologic borings, groundwater discharge temperature measurement, and piezometer measurements of groundwater levels and flow. Laboratory studies of major strata water-conducting properties were used to estimate water movement due to gradients. Results show that groundwater contributions to wetland volumes is minor compared to precipitation, however, surface ditching and drainage will have a definite if small effect on groundwater levels. Even this small level change may have a dramatic change on wetland permanence. Flood water volume and retention time will be reduced due to more rapid drainage. More long-term data are needed to assess the magnitude of change that will occur. (Seigler-IPA)
W80-02736

STATE-OF-THE-ART OF GROUNDWATER MODELING,
Camp, Dresser, and McKee, Inc., Champaign, IL. Water Resources Div.
T. A. Prickett.
Water Supply and Management, Vol 3, No 2, p 134-141, 1979. 80 Ref.

Descriptors: *Mathematical models, *Analog models, *Groundwater management, *Model studies, *Groundwater models, *Sand tank models, *Numeric models, Decision-making, Management, Computer models, Analytical techniques, Groundwater-surface relationships, Digital computers, Water resources management.

Outline of groundwater modeling techniques within the categories of mathematical, sand tank, analog and numerical models is presented. The models discussed are one of two types: groundwater 'flow' or 'transport' models. The term 'flow' refers to the type of model used to provide answers to the quantitative side of groundwater problems; typical 'flow' models would solve problems related to safe yields of well fields, interference effects of nearby wells and surface-water-groundwater relationships. The 'transport' model is a water quality type; typical 'transport' models might include energy considerations, dispersion and diffusion processes, chemical exchange reactions, or multiple fluid effects. Mathematical solutions are models of the particular conditions defined; their applications to field problems are therefore somewhat limited. Four main groups of flow models are discussed: (1) Sand tank models which are a scaled down representation of an aquifer, including its boundary configuration and usually its hydraulic conductivity. (2) Analog models, where the behavior of an aquifer is described by differential equations which are derived from basic principles such as the laws of continuity and conservation of energy. (3) Analog models, which can be subdivided into the three major categories of viscous fluid models, electrical models, and miscellaneous models and techniques. (4) Numerical models, which have been powerful tools in aiding hydrologists in evaluating groundwater resources. Development of the digital computer has made possible the practical use of the techniques in groundwater flow modeling. Numerical models can be subdivided into four groups: finite-difference, finite-element variational, finite-element Galerkin, and miscellaneous. (Iervolino-NC)
W80-02866

GROUND-WATER RESOURCES AND MODEL APPLICATIONS FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER IN THE SAN ANTONIO REGION, TEXAS,
Texas Dept. of Water Resources, Austin.
W. B. Klemt, T. R. Knowles, G. R. Elder, and T. W. Sieh.
Report 239, October 1979. 94 p, 30 Fig, 6 Tab, 60 Ref.

Descriptors: *Groundwater resources, *Model studies, *Texas, *Aquifers, *Water management(Applied), *Hydrogeology, Data collections, Natural recharge, Stratigraphy, Water levels, Groundwater recharge, Discharge(Water), Springs, Groundwater movement, Aquifer characteristics, Permeability, Porosity, Mathematical models, Pumping, Water yield, Forecasting, *Edwards aquifer(TX), *Balcones fault zone.

The scope of the study was primarily directed toward the quantitative aspects of groundwater withdrawals, spring flows, and aquifer characteristics. A digital computer model of the Edwards (Balcones Fault Zone) aquifer was successfully verified by taking historical input data (initial heads, pumpage, recharge, and other data) and computing water-level changes and spring flows which agree well with water-level declines and spring flows observed from actual field measurements. The digital computer simulation for the period 1972 through 2049 of the Edwards (Balcones Fault Zone) aquifer in the San Antonio region indicates the following: (1) ignoring any water-quality constraints, the aquifer is capable of meeting projected demands through the year 2049; (2) natural flow of Comal and San Marcos Springs will cease before the year 2020, if projected pumpage in the region occurs at predicted rates; (3) the addition of currently proposed artificial recharge does not result in an appreciable increase in the aquifer's available water; (4) the drought-flood sequence of the 1950's was introduced at various points in the simulation and produced only minor effects when compared to the aquifer's long-term simulation; (5) spring flows at Comal Springs and San Marcos Springs can be maintained through groundwater management plans; and (6) there is sufficient storage in the aquifer to allow spring flow of Comal and San Marcos Springs to be replaced by augmentation pumpage through the year 2020. (Humphreys-ISWS)
W80-02883

A FLOW PATTERN DEDUCED FROM URANIUM DISEQUILIBRIUM STUDIES FOR THE CENOMANIAN CARBONATE AQUIFER OF THE BEERSHEVA REGION, ISRAEL,
Tel Aviv Univ., (Israel). Dept. of Geophysics and Planetary Sciences.
J. Kronfeld, E. Gradsztajn, and A. Yaniv.
Journal of Hydrology, Vol 44, No 3/4, p 305-310, December 1979. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Isotope studies, *Aquifers, *Groundwater movement, *Uranium radioisotopes, Flow, Carbonate rocks, Calcium, Sulfates, Wells, Leaching, Sampling, Saline water, Groundwater recharge, *Israel.

Changes in the uranium isotopic activity ratio and uranium content are correlated to changes in the calcium and sulphate content in waters from wells in various locations in the Cenomanian aquifer in the Beersheva region. These changes are related to an isotopically non-selective leaching of uranium from the overlying uranium- and sulphate-enriched Senonian rocks as the waters flow. A flow pattern, therefore, can be produced by plotting these systematic changes on a regional map. (Visocky-ISWS)

W80-02889

PORE SIZE DISTRIBUTION, SUCTION AND HYSTERESIS IN UNSATURATED GROUND-WATER FLOW,
Nevada Univ. System, Reno. Water Resources Center.
For primary bibliographic entry see Field 2G.
W80-02892

HYDRAULIC POTENTIAL IN LAKE MICHIGAN BOTTOM SEDIMENTS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 2H.
W80-02893

THE ROLE OF GROUNDWATER IN STORM RUNOFF,
Windsor Univ. (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 2E.
W80-02894

HYDROGEOLOGY OF GLACIAL-TERRAIN LAKES, WITH MANAGEMENT AND PLANNING APPLICATIONS,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 2A.
W80-02895

SEPTIC TANK WASTEWATER DISPOSAL SYSTEMS AS PHOSPHORUS SOURCES FOR SURFACE WATERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-02904

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--PACIFIC NORTHWEST REGION,
Geological Survey, Seattle, WA. Water Resources Div.
B. L. Foxworthy.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.25 Geological Survey Professional Paper 813-S, 1979. 39 p, 9 Fig, 2 Tab, 104 Ref.

Descriptors: *Groundwater resources, *Pacific Northwest U.S., *Aquifer characteristics, *Withdrawal, *Water demand, Water quality, Water supply, Groundwater availability, Projections, Evaluation, Aquifer management, Idaho, Oregon, Washington.

The Pacific Northwest Region's ground-water reservoirs are capable of providing large additional freshwater supplies, which become more important as surface-storage sites and unapportioned surface-water supplies dwindle. Withdrawals of freshwater from all sources are increasing and may be about double the 1970 rate by 2020. By 1975 the withdrawal of ground water had increased 70 percent over the 1970 rate, and accounted for 22 percent of total freshwater withdrawal. To meet projected water demands substantial increases in ground-water withdrawal must continue. The availability of and needs for ground water in the region vary largely because of the great variety of landforms, climate, and earth materials. More than one half the region is underlain by rock materials capable of yielding ground water to wells at moderate to large rates; major ground-water reservoirs exist in six extensive areas. The most significant current problems pertaining to these ground-water reservoirs are: (1) declining water levels and depletion of supply; (2) water-quality deterioration; (3) waterlogging; (4) inadequate information; and (5) competition for available supplies. In the future these same problems are expected to persist and generally worsen in most of the major reservoir areas. (Woodard-USGS)
W80-02928

GROUND-WATER LEVELS AND QUALITY DATA FOR GEORGIA, 1978,
Geological Survey, Doraville, GA. Water Resources Div.
J. S. Clarke, W. G. Hester, and M. P. O'Byrne.
Geological Survey open-file report 79-1290, August 1979. 94 p, 7 Ref.

Descriptors: *Georgia, *Groundwater, *Water levels, *Water quality, *Water wells, Well data, Water level fluctuations, Aquifers, Hydrographs, Saline water intrusion, Chlorides, Data collections.

Mean water levels in wells across Georgia were from 0.25 foot higher to 11.4 feet lower in 1978 than in 1977, and in some areas were the lowest on record. Water levels in the principal artesian aquifer underwent a long-term decline during the period 1969-78. In some areas water levels dropped more than 10 feet. Wells tapping the Clayton Limestone in the Albany area showed a long-term decline during the period 1969-78, and in some wells water levels dropped more than 20 feet. Water levels in the Cretaceous aquifer system showed little fluctuation during 1978; however, in a well located in Chattahoochee County, water levels declined 4.4 feet during 1969-78. In the Piedmont area mean water levels remained the same to 2.2 feet lower in 1978 than in 1977, and showed no long-term trend. Chloride concentrations in the principal artesian aquifer in the Savannah area remained stable and in the Brunswick area continued to rise during 1978. Daily mean water-level fluctuations and trends for 1978 and fluctuations of the monthly mean water level for the previous 10 years are shown in hydrographs of 33 selected observation wells in Georgia. Chloride concentrations in 11 wells in the Savannah and Brunswick areas are shown in graphs of monthly values over the previous 10 years. A short narrative explains fluctuations and trends in each of the hydrographs and chloride concentration graphs shown. (Woodard-USGS)
W80-02931

COMPUTER SIMULATION AND GEOHYDROLOGY OF A BASALT AQUIFER SYSTEM IN THE PULLMAN-MOSCOW BASIN, WASHINGTON AND IDAHO,
Geological Survey Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-02935

2G. Water In Soils

THE INFLUENCE OF CANAL SEEPAGE ON GROUNDWATER IN LUGERT LAKE IRRIGATION AREA,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
D. L. Nofziger, C. E. Rice, and Sarmud Mishu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134034, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Technical Completion Report, November, 1979. 32 p, 11 Fig, 3 Tab, 6 Ref, 2 Append. OWRT A-080-OKLA(1), 14-34-0001-9038.

Descriptors: *Canal seepage, Ponding, *Seepage meter, *Soil salinity, Drainage, Groundwater, *Water loss, Irrigation canals, Soil water.

Seepage from irrigation canals in the Lugert Lake Irrigation area has been considered a major contribution to the perched water table and to soil salinity problems in the area. This research was conducted to quantify water losses from the canals and to determine the influence of the water losses on the soil water. Seepage rates were measured by ponding for canals less than 4 m wide. The rates ranged from 0.35 to 0.78 cm/hr (0.13 to 0.44 ft3/sec/mi) for canals in regions with clay loam surface soils and from 1.09 to 1.24 cm/hr (0.33 to 0.48 ft3/sec/mi) for regions with sandy loam surface soils. Seepage rates for the large main canals were measured with seepage meters, but the method proved unreliable. Water losses for the main canals calculated from measured rates on smaller canals were 0.85 to 1.3 ft3/sec/mi for clay loam soils and 1.3 to 2.0 ft3/sec/mi for sandy loam soils. Water-table elevations in the vicinity of the canals increased 100 to 200 cm near the canals and 60 to 120 cm at distances greater than 100 m from the canals. The elevations increased rapidly soon after water was placed in the canals and decreased rapidly after the canals were emptied. Water losses from the smaller canals were sufficient to account for up to 50% of the observed change in water-table elevation in the surrounding soil. Water losses from the main canals accounted for up to 100% of the change in the water table elevations.
W80-02706

RANGELAND HYDROLOGY IN AUSTRALIA -- A BRIEF REVIEW,
Utah State Univ., Logan. Watershed Science Unit.
G. F. Gifford.
Australian Rangeland Journal, Vol 1, No 2, p 150-166, 1978. 147 Ref.

Descriptors: *Australia, *Hydrology, *Soil-water-plant relationships, *Ranges, Grasslands, Infiltration, Interception, Groundwater recharge, Stemflow, Throughfall, Evapotranspiration, Soil moisture, Range management, Grazing, Burning.

Australian rangelands, areas where rainfall is not sufficient for crop production, cover about 5,703,703 sq km. A review of published hydrology studies of these rangelands is presented with emphasis on surface waters. Hydrologic processes are quantified in both 'natural' and 'modified' rangeland plant communities. The review provides an overall picture of the various factors involved in the hydrologic cycle for the rangelands to aid in better rangeland management. Hydrologic factors reviewed include: precipitation patterns, interception, throughfall, stemflow, infiltration, soil moisture storage, groundwater recharge, and evapotranspiration. The kinds of rangeland discussed are high elevation rangelands, improved pasture vs forest, grasslands, shrubs, scrubland, and water repellent soils. Reference is made to various models of water use, soil moisture patterns, and productivity as related to soil moisture patterns. The impacts on water runoff and quality of vegetation modification, grazing, pasture improvement, transmission losses, small structures, winter harvesting, burning, and snowpack management are also covered. (Seigler - IPA)
W80-02745

WATER MOVEMENT IN A LAND TREATMENT SYSTEM OF WASTEWATER BY OVERLAND FLOW,
Army Terrestrial Sciences Center, Hanover, NH. Applied Research Branch.
Y. Nakano, R. A. Khalid, and W. H. Patrick, Jr.
Progress in Water Technology, Vol 11, No 4/5, p 185-206, 1979. 12 Fig, 5 Tab, 15 Ref.

Descriptors: *Sewage effluents, *Waste water disposal, *Soil water movement, On-site investigations, Model studies, Mathematical models, Shallow water, Overland flow, Infiltration, Evapotranspiration, Theoretical analysis, Equations, Hydraulic conductivity, Hydraulic properties, Soil water, Waste water treatment, Land treatment systems.

Water movement in an overland-flow land treatment system was studied experimentally and theoretically. A small-scale physical model was used to obtain experimental data. The theoretical analysis was based upon the shallow water equation for overland flow and the Darcy-Richards law for soil water flow. It was found that the water movement in the system was primarily controlled by the application rate, the friction slope, the slope angle, the hydraulic characteristics of soils, and the evapotranspiration. An approximate analytical solution to steady flow in the system was obtained. It was found that the rate of soil water flow was mainly determined by the saturated conductivity of soils and in less extent by the friction slope and the slope angle in the steady condition. A finite difference solution to non-steady flow was found satisfactory in simulating the experimental data. (Sims-ISWS)
W80-02853

PORE SIZE DISTRIBUTION, SUCTION AND HYSTERESIS IN UNSATURATED GROUNDWATER FLOW,
Nevada Univ. System, Reno. Water Resources Center.
C. M. Case, and A. Welch.
Journal of Hydrology, Vol 43, No 1/4, p 99-120, October 1979. 7 Fig, 33 Ref, 3 Append.

Descriptors: *Soil water, *Hysteresis, *Groundwater, *Groundwater movement, *Model studies, Mathematical models, Soil water movement, Flow, Unsaturated flow, Pores, Pore water, Soil moisture, Capillary water, Hydrology, Pore size distribution, Suction.

Formalism for calculating soil moisture suction via average relative humidity in the soil was reviewed and then extended via the concept of pore size distribution. Using an assumed form for pore size distribution and a form of the Kelvin equation for the vapor pressure of a fluid in a capillary allowed direct calculation of the capillary contribution to suction under certain idealized conditions. The change in suction with changes in the concentration of total dissolved solids was then examined via the difference between the pressure of vapor over a pure solvent and that over a solution and changes in surface tension that occur when impurities are dissolved in water. The pore size distribution and an assumed form of volume per pore/capillary were used to construct and calculate the degree of saturation theta sub s(r) where the assumption is made that all pores/capillaries in the sample under consideration up to radius r are filled and those having radii larger than r are dry. Later in the development it was shown how this initial assumption can be refined. Negative suction and the degree of saturation theta sub s were calculated as explicit functions of r and plotted as implicit functions of each other, thereby yielding one of the family of hysteresis loops appropriate to the current formalism. If r sub o is the value of r for which the pore size distribution curve has its peak, the value of r sub o for the wetting branch is larger than that for the drying branch, since the drying curve 'sees' smaller pores/capillaries on the average than does the wetting curve. The area enclosed by the hysteresis loop was calculated and represents the energy per unit volume lost to the formation on adsorbing and then desorbing moisture. (Sims-ISWS)
W80-02892

LEACHING OF POLLUTANTS FROM SANITARY LANDFILL MODELS,
Technion-Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 5B.
W80-02905

ANOMALIES IN CATION CONCENTRATIONS DURING PERCOLATION OF SIMULATED EFFLUENT THROUGH SAND,
California Inst. of Tech., Pasadena.
For primary bibliographic entry see Field 5B.
W80-02906

THERMAL DIFFUSIVITY AND CONDUCTIVITY OF MOIST POROUS MEDIA,
Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.
R. J. Parikh, J. A. Havens, and H. D. Scott.
Soil Science Society of America Journal, Vol 43, No 5, p 1050-1052, September-October 1979. 3 Fig, 5 Ref, 1 Append. OWRT A-039-ARK(2), A-042-ARK(1), 14-31-0001-6004.

Descriptors: *Porous media, *Moisture content, *Thermal conductivity, *Heat flow, Laboratory tests, Soils, Loam, Measurement, Numerical analysis, Model studies, Mathematical models, Heat, Temperature, Soil science, Thermal diffusivity.

An unsteady-state method was used to determine thermal diffusivities and conductivities of nominally 250 micrometer glass beads and a silt loam soil over a range of moisture contents. The thermal diffusivity of the beads was found to increase from 0.0013 sq cm/sec for dry beads to 0.003 sq cm/sec at 5% volumetric moisture content, but is only weakly affected by moisture contents greater than 5%. The thermal diffusivity of the silt loam soil increases from 0.0022 sq cm/sec for dry soil to 0.0042 sq cm/sec at 30% volumetric moisture content, above which it remains essentially constant with increasing moisture content. The thermal conductivities of both porous media increase with moisture content over the entire wetness range, the thermal conductivity of the glass beads increasing from 0.53 mcal/deg C/cm/sec to 1.97 mcal/deg C/cm/sec, and that of the silt loam soil from 0.57 mcal/deg C/cm/sec to 2.79 mcal/deg C/cm/sec. Measured thermal conductivities of the glass bead media were in excellent agreement with values calculated using deVries' method. (Sims-ISWS)
W80-02915

2H. Lakes

A FIELD STUDY OF THE PHYSICAL EFFECTS OF THERMAL DISCHARGES AT LA CYGNE LAKE, KANSAS,
Kansas Univ., Lawrence. Dept. of Chemical and Petroleum Engineering.
J. Wagner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133135, Price codes: A04 in paper copy, A01 in microfiche. Ph.D. Thesis (1979). 678 p, 72 Fig, 26 Tab, 93 Ref, 11 Append. OWRT B-032-KAN(3).

Descriptors: *Temperature distributions, Three dimensional, *Powerplants, *Limnology, Effects, Thermal discharges, Water circulation, *La Cygne Lake(KS).

Field studies were conducted at La Cygne Lake (871 ha) in eastern Kansas in order to determine the physical effects of thermal discharges from an 840 Mw power generating station. The results cover three and one-half years of study, including periods before and after plant startup. Temperature measurements defined the seasonal variation in lake temperatures, which were dominated by local climatological conditions. Discharge of thermal effluents resulted in both vertical and horizontal temperature gradients. Detailed descriptions of the temperature distributions under several combinations of meteorological and plant operating conditions showed a different temperature distribution for each set of conditions. There was no 'typical' temperature distribution. In all cases lake temperatures were three dimensional and closely related to current velocities. Methods proposed in the literature for predicting temperature distributions in shallow lakes and cooling ponds were evaluated on the basis of field observations at La Cygne Lake. One-dimensional models formulated on an oversimplification of lake hydrodynamics were found to be inadequate for shallow lakes, such as La Cygne Lake, where both the flow field and temperature distributions vary in time and all three spatial dimensions. Combinations of one-dimensional models which attempt to account for the multidimensional nature of the system suffer the same limitations as the individual one-dimensional models.
W80-02703

EFFECTS OF WHOLE LAKE MIXING ON ALGAE, FISH, AND WATER QUALITY,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
D. W. Toetz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133200, Price codes: A04 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Technical Completion Report, November 1979. 46 p, 8 Fig, 16 Tab, 25 Ref. OWRT A-078-OKLA(1), 14-34-0001-9038.

Descriptors: *Reservoirs, *Artificial destratification, *Water quality, Algal biomass, Community metabolism, Oklahoma, Lakes, Mixing.

This report describes the effects of artificial mixing of two Oklahoma lakes with a downflow (Garton) pump on water quality, algal biomass, and community metabolism. Artificial pumping in Arbuckle Lake (951 ha), advanced the autumnal turnover, but never completely destratified the lake. Ammonia and BOD5 decreased in the epilimnion, while dissolved oxygen (DO) increased and sulfide (S-) declined in the hypolimnion. Near-bottom concentrations of Mn++ increased. Pumping did not change significantly the depth of the Secchi disc or algal biomass. Community metabolism data failed to confirm that artificial lake mixing changes the ecosystem from autotrophic to heterotropic. The Garton pump seldom produced completely isothermal conditions or isochemical concentrations of DO in Ham's Lake (41 ha) and no measurable change in water quality, but pumping decreased water clarity and increased algal biomass.
W80-02705

TEMPERATURE AND DISSOLVED OXYGEN DATA FOR LAKE ONTARIO, 1972 (IFYGL),
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. D. Boyd, and B. J. Eadie.
NOAA Technical Memorandum ERL GLERL-21, August 1978. 218 p, 1 Fig, 3 Tab, 2 Append.

Descriptors: *Lake Ontario, *Canada, *Dissolved oxygen, Dissolved oxygen analyzers, Instrumentation, Oxygen, Water temperature, Water sampling, Statistical methods, Data collections, Lakes, Great Lakes, Monitoring.

Dissolved oxygen profiles for Lake Ontario are presented. The data for the profiles were gathered in 1972 during the joint Canadian-United States International Field Year for the Great Lakes (IFYGL). An oceanographic research vessel, the U.S. RV Researcher, was furnished by the National Oceanic and Atmospheric Administration (NOAA) to gather the data. The Researcher was equiped with an electrobathy thermograph (EBT), a dissolved oxygen monitor (DOM), and a rosette multisampler array. The original data were edited, corrected, and averaged to produce the profiles. The profiles give temperature, dissolved oxygen, and oxygen percent saturation at up to 27 discrete depths. Latitude, longitude, location, and cruise number and the date are provided for the 105 locations sampled. A statistical data summary is presented along with the actual depth, temperature, dissolved oxygen, and percent saturating values for each available cruise and station combination used for the profiles. Data are available from the National Climatic Center, Ashville, North Carolina, on magnetic tape. (Seigler-IPA)
W80-02727

DISTRIBUTION OF PHYTOPLANKTON IN IOWA LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
L. R. Williams, S. C. Hern, V. W. Lambou, F. A. Morris, and M. K. Morris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 608, Price codes: A04 in paper copy, A01 in microfiche. Report No EPA-600/3-79-062, June 1979. 53 p, 34 Tab, 12 Ref, 2 Append.

Descriptors: *Phytoplankton, *Iowa, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae, Microorganisms, Microscopy.

In 1974, 15 Iowa lakes were sampled as a part of the National Eutrophication Survey. Phytoplankton species and abundance were determined in an effort to establish the relationship between algae characteristics and lake trophic status. The lakes sampled: (1) were all impacted by one or more sewage treatment plant outfalls; (2) were 40 hectares or larger; and (3) had a mean hydraulic retention rate of at least 30 days. Most lakes were sampled three times during the year at a site reflecting the deepest portion of each major basin in the lake. Depth-integrated samples to a depth of 15 feet or to the bottom were taken and shipped to the laboratory for analysis. Microscope slides were prepared and examined by several techniques to identify and count the phytoplankton. An overall

list of the phytoplankton in the 15 lakes is provided. All data collected are summarized by lake with an alphabetical phytoplankton species list with concentrations for individual species by sampling date. Results from the application of several indices (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are included. (Seigler-IPA)
W80-02731

DISTRIBUTION OF PHYTOPLANKTON IN KANSAS LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
L. R. Williams, S. C. Hern, V. W. Lambou, F. A. Morris, and M. K. Morris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 792, Price codes: A03 in paper copy, A01 in microfiche. Report No EPA-600/3-79-063, June 1979. 50 p, 34 Tab, 12 Ref, 2 Append.

Descriptors: *Phytoplankton, *Kansas, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae, Microorganisms, Microscopy.

Fifteen Kansas lakes were sampled in 1974 as a part of the National Eutrophication Survey. Phytoplankton species and abundance data were collected in an effort to determine the relationships between algae characteristics and lake trophic status. The lakes selected for the survey had actual or potential accelerated eutrophication problems, and: (1) were impacted by one or more municipal sewage treatment plant outfalls, (2) were 40 hectares or larger, and (3) had a mean hydraulic retention time of at least 30 days. Major lake basins were sampled three times during the year. A depth-integrated phytoplankton sample was taken at each site. Samples were preserved, concentrated, and slides were prepared. Various microscope techniques were used to identify and count the phytoplankton. A general overall phytoplankton list is provided for the 15 lakes. All of the data are also summarized by lake including an alphabetical species given by sampling date. Results from the application of several indices, (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are also presented. (Seigler-IPA)
W80-02732

DISTRIBUTION OF PHYTOPLANKTON IN NEBRASKA LAKES,
Nevada Univ. Las Vegas. Dept. of Biological Sciences.
F. A. Morris, M. K. Morris, W. D. Taylor, L. R. Williams, and S. C. Hern.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 794, Price codes: A03 in paper copy, A01 in microfiche. Report No EPA-600/3-79-066, June 1979. 37 p, 22 Tab, 12 Ref, 2 Append.

Descriptors: *Phytoplankton, *Nebraska, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae, Microorganisms, Microscopy.

Species and abundance data for phytoplankton in nine Nebraska lakes sampled during the National Eutrophication Survey in 1974 are presented. Phytoplankton data were collected and analyzed in an effort to determine relationships between algae characteristics and lake trophic status. All lakes sampled had actual or potential accelerated eutrophication problems and: (1) were impacted by one or more municipal sewage treatment plant outfalls; (2) were 40 hectares or larger; and (3) had a mean hydraulic retention rate of at least 30 days. A depth integrated sample was taken at each site usually three times during the year. Samples were preserved, concentrated, and slides were made. Various microscopic techniques were used to identify and count the phytoplankton. An overall list is provided for the phytoplankton identified in the nine lakes. Data are also summarized by lake including an alphabetical species list with concentrations for individual species by sampling date. Results from the application of several indices (Nygaard's Tropic State, Palmer's Organic Pollution, and species diversity and abundance) are included. (Seigler-IPA)
W80-02733

DISTRIBUTION OF PHYTOPLANKTON IN OKLAHOMA LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
S. C. Herns, V. W. Lambou, F. A. Morris, M. K. Morris, and W. D. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 796, Price codes: A04 in paper copy, A01 in microfiche. Report No EPA-600/3-79-068, June 1979. 55 p, 34 Tab, 12 Ref, 2 Append.

Descriptors: *Phytoplankton, *Oklahoma, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae, Microorganisms, Microscopy.

Data are presented on the species and abundance of phytoplankton in 15 Oklahoma lakes. The lakes were sampled in 1974 as a part of the National Eutrophication Survey to determine the relationship between algal characteristics and lake trophic status. All lakes sampled had actual or potential accelerated eutrophication problems and: (1) were impacted by one or more municipal sewage treatment plant outfalls; (2) were 40 hectares or larger; and (3) had a mean hydraulic retention rate of at least 30 days. At each site a depth-integrated phytoplankton sample was taken. A lake was usually sampled three times during the year. Samples were concentrated and slides were made for microscopic examination. An overall phytoplankton list is provided for the 15 lakes. Data are summarized by lake including an alphabetical species list with concentrations for individual species by sampling date. Results from the application of several indices (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are included. (Seigler-IPA)
W80-02734

DISTRIBUTION OF PHYTOPLANKTON IN NORTH DAKOTA LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
W. D. Taylor, L. R. Williams, S. C. Hern, V. W. Lambou, and F. A. Morris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 795, Price codes: A03 in paper copy, A01 in microfiche. Report No EPA-600/3-79-067, June 1979. 48 p, 32 Tab, 12 Ref, 2 Append.

Descriptors: *Phytoplankton, *North Dakota, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae, Microorganisms, Microscopy.

Species and abundance data for phytoplankton in 14 North Dakota lakes sampled during the National Eutrophication Survey in the spring, summer, and fall of 1974 are presented. Phytoplankton data were collected and analyzed in an effort to determine the relationship between algae characteristics and lake trophic status. All lakes selected for sampling: (1) were impacted by one or more municipal sewage treatment plant outfalls; (2) were 40 hectares or larger; and (3) had a mean hydraulic retention rate of at least 30 days. A depth-integrated phytoplankton sample was taken at the deepest portion of each major basin in lakes tested. Samples were preserved and concentrated and slides were made for microscope examination. A general overall phytoplankton list for the 14 lakes is presented. Also, data are summarized by lake including an alphabetical phytoplankton species list with concentrations for individual species by sampling date. Results from the application of several indices (Nyaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are included. (Seigler-IPA)
W80-02735

LAKE RESTORATION, PROCEEDINGS OF A NATIONAL CONFERENCE, AUGUST 22-24, 1978, MINNEAPOLIS, MINNESOTA.
Available from U.S. Government Printing Office, Washington, DC 20402, Stock No 055-001-01084-2, $4.50. Report No EPA 440/5-79-001, March 1979. 262 p, 2 Append.

Descriptors: *Water management(Applied), *Eutrophication, *Lakes, *Conferences, Lake stages, Phosphorus, Water quality control, Watersheds(Basins), Water treatment, Water pollution treatment, Federal Water Pollution Control Act, Watershed management, Government finance, Grants, Planning.

The practical application of lake restoration technology is discussed in the 32 papers presented at the conference. The U.S. Environmental Protection Agency's clean lakes program is the source of funding for much of the technological progress cited. The past, present, and future needs and goals of the program are presented. Major areas of subject matter covered are: (1) Federal, State, and local programs, (2) assessing the problem and alternative solutions, (3) in-lake treatments, and (4) state of the art research. (See W80-02774 thru W80-02805) (Seigler-IPA)
W80-02773

PUTTING OURSELVES IN OUR PLACE,
House of Representatives, Washington, D.C.
D. M. Fraser.
In: Lake Restoration, Report No EPA 440/5-79-001, p. 7-9. 1979.

Descriptors: *Lake stages, *Federal Water Pollution Control Act, Water quality control, Eutrophication, Legislation, Water pollution control, Lakes, Environmental effects, Algae.

The growing awareness of the need for actions and funding to protect the environment is discussed in terms of lake quality and restoration. The old American attitude that the environment needed to be subdued and molded to fit man's needs began to fade rapidly in the 1960s and a growing concern for the destruction of environment is replacing it. Minnesota, the 'Land of 10,000 Lakes' has been and still is a leader in its concern and actions in lake restoration. In 1971 a Clean Lakes Act was introduced by former Senator Mondale and in 1972 it became a part of the Federal Water Pollution Control Act Amendments. Congress authorized $300 million for 1972-1975 for the program to help states with lake restoration. However, very little of the money was ever made available. The current administration has requested $15 million for the program in 1979, but still more is needed. Since 1976, 73 lakes in 23 states have been aided by the program. Only a small start has been made with lake restoration, much more is needed in the form of grants and research and development to prevent the ecological death of many lakes. (See also W80-02773) (Seigler-IPA).
W80-02774

REGION V CLEAN LAKES PROGRAM,
Environmental Protection Agency, Chicago, IL. Region V.
C. H. Sutfin.
Report No EPA/ 440/5-79-001, In: Lake Restoration, p. 17-19, 1979.

Descriptors: *Lakes, *Water pollution, *Grants, Minnesota, Septic tanks, Sewage effuents, Dredging, Government supports, Eutrophication, Lake stages, Water quality, Phosphorus, Monitoring, Limnology.

Region V continues to be a leader with its Clean Lakes Program. Lake inventories for the area include results from 34,000 lakes or 36% of the national lake total for the 48 contiguous states. Lake surveys and classifications are expected to increase in frequency and intensity as closer rela-

tionships develop between performing agencies. Region V currently has 18 Environmental Protection Agency grants totaling $17.3 million. Of the projects, 71% are for watershed controls for urban or agricultural nonpoint source drainage. Program focus is predominantly on urban lakes, especially in Minnesota for the Twin Cities area. Dredging is the predominant technique used for correcting effects of past abusive land use practices. Although none of the 18 projects has yet produced sufficient data to measure its success, seven projects have shown some favorable results. Most notable are the White Clay and Mirror Lake projects both of which have produced beneficial results. The region is supplying additional manpower to provide preapplication assistance and program administration assistance. A handbook is being developed to assist communities in assessing the degree of lake pollution from septic tanks. (See also W80-02773) (Seigler-IPA)
W80-02776

APPLIED LIMNOLOGY IN THE STATE OF MAINE,
Maine Dept. of Environmental Protection, Augusta.
M. Scott.
Report No EPA 440/5-79-001, In: Lake Restoration, p 21-24, 1979 21 Ref.

Descriptors: *Maine, *Limnology, Eutrophication, Lake stages, Lakes, Phosphorus, Watersheds(Basins), Water quality, Monitoring, Model studies, Water chemisty, Water pollution control, Surveys.

Maine has 3,000 glaciated lakes with the deepest being Sebago Lake and the largest being Mosshead Lake. Most early limnology survey work was performed by the inland fisheries. In the 1970s, the Maine Department of Environmental Protection formed the Division of Lakes and Biological Studies to perform work in applied limnology. The Division has made continuing progress to protect and restore the lakes in Maine. Extensive laboratory studies were performed in nutrient limitation for whole lake situations, modeling, and nutrient budgets. Detailed monitoring of Maine's lakes was conducted by volunteers and substantial quantities of baseline limnological data were collected. Other accomplishments include the Haley Pond restoration project, a project funded through section 314 of the Federal Water Pollution Control Act, uses biological manipulation of a filter feeder to reduce Zooplankton numbers, and model development and utilization. Future efforts will focus on lake protection to prevent the need for lake restoration. More regulations are needed for: a total phosphate band in detergents, state legislation on section 314 funds, sediment and errosion control, water levels in reservoirs, forestry and agricultural practices, drainage areas, chemical usage, remote pond protection, and an expanded monitoring program. The establishment would help in meeting future goals in lake protection and restoration. (See also W80-02773) (Seigler-IPA)
W80-02777

ESTABLISHING A LAKE RESTORATION PROGRAM IN MINNESOTA,
Minnesota Pollution Control Agency, Roseville.
J. G. Schilling.
In: Lake Restoration, Report No EPA 440/5-79-001, p 41-42, 1979.

Descriptors: *Minnesota, *Lakes, *Water management(Applied), Water quality control, Administration, Urbanization, Agriculture, Eutrophication, Government supports, Tourism, Income, Freshwater, Environmental effects, Mining.

More funding and a coordinated lake restoration and protection program are needed for Minnesota's lakes. Minnesota has the largest number of freshwater lakes in the continental U.S. with 12,000 lakes larger than 10 acres in surface area. At present there is no coordinated program for lake management, protection, and restoration and water resources management is burdened with overlapping jurisdictions of various governmental bodies. Only about 2% of the State's budget goes for all expenditures related to the environment with all funds for lake protection coming out that 2%. It is estimated that each acre of surface water brings in $300 annually from tourist trade while only $40 per acre is spent annually to protect that acre of lake. There seems to have been little impact on the State level from the loss of productive lakes, however, effects on local economics are much more severe. Although little surveying and research has been done, it is expected that increasing pressure will be put on Minnesota's lakes by increased tourist trade, urbanization, expanding agricultural usage, and a developing mining industry. While some progress has been made in obtaining increased funding from State and Federal sources and in establishing a comprehensive water resources management program, much more is needed. (See also W80-02773) (Seigler-IPA)
W80-02781

INTERRELATIONSHIP OF THE CLEAN LAKES PROGRAM AND WATER QUALITY MANAGEMENT,
Environmental Protection Agency, Washington, DC. Water Planning Div.
J. A. Krivak.
In: Lake Restoration, Report No EPA 440/5-79-001, p 51-53, 1979.

Descriptors: *Water management(Applied), *Government supports, *Legislation, Lakes, Water quality control, Planning, Administration, South Carolina, South Dakota, Project planning, Federal government, Grants, Governmental interrelations, State governments.

An Environmental Protection Agency (EPA) analysis of 54 clean lake projects showed that about two-thirds of the projects are preventative and curative, while about one-third of the programs treat only the symptoms of lake problems and not the causes. About 24% of the projects has a high degree of coordination between project sponsor and State water quality management programs, 43% had a low degree of coordination, and 33% had almost no coordination. On the Federal level, high coordination indicating active participation by another Federal agency was found in 17% of the projects, low coordination in 20%, and no coordination in the rest of the projects. These results indicate that: (1) a clear set of objectives and priorities needs to be developed at the State level, (2) more emphasis is needed on preventative and curative restoration measures, (3) a comprehensive water quality management program is needed, and (4) all applicable programs in specific project areas need to be coordinated. New State/EPA agreements are expected to help with coordination. Also expected to help is section 208 of the Clean Water Act which can be used to initiate and manage projects. The Model Implementation Projects (MIP's), a series of projects with similar objectives to the clean lakes programs have resulted from 208 planning. Project examples are Broadway Lake in South Carolina and Lake Herman in South Dakota. Continued program integration is needed to provide more effective water quality management. (See also W80-02773) (Seigler-IPA)
W80-02784

MEASUREMENT AND USES OF HYDRAULIC AND NUTRIENT BUDGETS,
Ontario Ministry of the Environment, Rexdale.
W. A. Scheider, J. J. Moss, and P. J. Dillon.
In: Lake Restoration, Report No EPA 440/5-79-001, p 77-83, 1979. 6 Fig, 4 Tab, 24 Ref.

Descriptors: *Canada, *Model studies, *Hydraulic models, *Nutrients, Lakes, Lake stages, Eutrophication, Cycling nutrients, Phosphorus, Groundwater, Sedimentation, Runoff, Watersheds(Basins), Mathematical models, Evaporation, Evapotranspiration.

Lake assessment techniques for constructing nutrient and hydraulic lake budgets are described; Harp Lake in Ontario is used as an example. Hydraulic and nutrient budgets plus the physical characteristics of a lake must be determined in order to construct a mass balance model for lake management use in the control of eutrophication. Hydraulic budget development requires the collection of many samples by various methods to determine values for storage in watershed, precipitation, evapotranspiration, runoff, groundwater, storage in lake, evaporation, lake outflow and lake volume. A phosphorus budget model was used in the construction of the Harp Lake nutrient budget although other more complex models can be used. The change in phosphorus in lake phosphorus concentration with time was equated to the phosphorus input per unit lake volume less the phosphorus lost through outflow and sedimentation. Both hydraulic and phosphorus budgets for Harp Lake are summarized and various alternative calculation methods are discussed for each budget. (See also W80-02773) (Seigler-IPA)
W80-02789

ARTIFICIAL AERATION AS A LAKE RESTORATION TECHNIQUE,
Limnological Associates, San Diego, CA.
A. W. Fast.
In: Lake Restoration, Report No EPA 440/5-79-001, p 121-131, 1979. 16 Fig, 59 Ref.

Descriptors: *Aeration, *Dissolved oxygen, *Thermal stratification, *Hypolimnion, Limnology, Eutrophication, Water circulation, Upwelling, Mixing, Lakes, Aquatic algae, Nutrient removal, Agriculture, Nitrogen, Anaerobic conditions.

Artificial aeration, the direct addition of air or oxygen to lake water sometimes including water circulation, is mainly used as a restoration technique in lakes that are deep enough to stratify thermally. The two types of lake aeration systems are destratification and hypolimnetic. With destratification, air from a compressor is pumped into deep water where its release causes hypolimnetic water to upwell. This results in a mixing of water temperatures and oxygen content with both becoming more uniform throughout the lake. However, mixing is usually not complete which can result in algal growth problems. Hypolimnetic aeration provides aeration of the hypolimnetic wastes without mixing with surface wastes. These aeration methods include air injection, pure oxygen injection, and mechanical means. Both destratification and hypolimnetic methods can effectively reduce hydrogen sulfide, iron, manganese, and other conditions associated with anaerobisis. Aeration techniques are also being used in aquaculture. A floating fish rearing system has been developed to utilize hypolimnetic aeration and to produce low cost fish while reducing lake nutrient content. An important aeration drawback is the production of excessive nitrogen which can cause fish kills. A flow chart of the logical sequential steps in the decision making process for using artificial aeration is presented. (See also W80-02773) (Seigler-IPA)
W80-02794

LAKE RESTORATION BY DILUTION,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. B. Welch.
In: Lake Restoration, Report No EPA 440/5-79-001, p 133-139, 1979. 11 Fig, 3 Tab, 9 Ref.

Descriptors: *Eutrophication, *Lake stages, *Washington, *Water management(Applied), Phosphorus, Chlorophyll, Algal control, Aquatic algae, Water quality control, Lakes, Lake sediments, Water pollution control, Water pollution treatment, Nutrients, Nutrient removal.

Dilution, the addition of large quantities of low-nutrient water to eutrophic lakes, is a relatively quick and predictable method of lake restoration. Dilution reduces both the concentration of nutrients and algal cells. The availability of large amounts of low-nutrient water is the main limitation on the use of dilution as a lake restoration technique. A simple continuity equation can be used to predict the short term nutrient reduction effects of dilution by large quantities of water. A term for sedimentation must be added for the prediction of long term changes from the addition of small quantities of low-nutrient water. Dilution was used for lake restoration at Moses Lake and Green Lake, both in the state of Washington. For

Moses Lake, dilution water came from the Columbia River. Moses Lake dilution resulted in a more than 50% improvement in phosphorus, chlorophyll a, and Secchi values. Long term dilution at a relatively low rate began in Green Lake in 1962. Green Lake results are excellent with a 90% decrease in chlorophyll a and a nearly fourfold increase in water clarity. Dilution is planned for Wapato Lake at Tacoma, Washington. Project costs are estimated at $70,000 to $75,000. Advantages of dilution are: (1) low cost when water is available, (2) immediate results, and (3) successful results when only moderate to high nutrient water is available. (See also W80-02773) (Seigler-IPA)
W80-02795

THE NEED FOR MORE BIOLOGY IN LAKE RESTORATION,
Minnesota Univ., Minneapolis. Limnological Research Center.
J. Shapiro.
In: Lake Restoration, Report No EPA 440/5-79-001, p 161-167, 1979. 8 Fig, 35 Ref.

Descriptors: *Eutrophication, *Biocontrol, *Biological treatment, Integrated control measures, Biological, Aquatic algae, Algal control, Plankton, Fish food organisms, Phosphorus, Nitrogen, Zooplankton, Chlorophyll, Lake Sediments, Fish, Carp.

Phosphorus loading has been almost the exclusive concern in lake restoration programs. This has led to a narrow view of lake eutrophication without the needed concern for important biological factors. The use of nonbiological data to determine phosphorus budgets does not consider the fact that aquatic organisms, both plant and animal, are capable of putting nutrients from sediments back into circulation. Nitrogen and other nutrients and organisms that feed on algae such as planktivorous fish and zooplankton all affect the algal concentration in lakes. Examples of the use of biological approaches to lake restoration include removal or elimination of sediment recycling organisms by either biological or mechanical means, manipulation of the planktivorous fish population, and direct alteration of algal populations. Algal population may be altered or shifted by adding carbon dioxide and/or lowering the pH. Many biological lake restoration techniques are inexpensive and relatively easy, however, care must be taken when dealing with biological relationships that are often not under control. (See also W80-02773) (Seigler-IPA)
W80-02798

PRELIMINARY FINDINGS OF MEDICAL LAKE RESTORATION,
Battelle-Pacific Northwest Lab., Richland, WA.
A. F. Gasperino, G. R. Keizer, and R. A. Soltero.
In: Lake Restoration, Report No EPA 440/5-79-001 p 209-214, 1979. 7 Fig, 3 Tab, 3 Ref.

Descriptors: *Chemical precipitation, *Eutrophication, *Aluminum, *Sulfates, Phosphorus, Water pollution control, Lakes, Lake stages, Washington, Nutrients, Aquatic algae, Phytoplankton, Dissolved oxygen, Chlorophyll.

Medical Lake, an alkaline eutrophic lake located 32 km southwest of Spokane, Washington, was treated with an application of aluminum sulfate (alum). Prior to treatment the lake exhibited large nuisance algal blooms and excessive nutrient concentration. The alum application was designed to restore the lake to a more usable state by reducing phosphorus and algal levels, increasing oxygen levels, and improving water clarity. Nutrient inactivation was the most cost-effective method for disrupting the phosphorus cycle. Lake water quality was monitored prior to, during, and after the alum application and results indicate that the treatment was highly successful. Monitoring will continue until spring of 1980. Positive results include a sixfold decrease in concentrations of total phosphate and total soluble phosphate, and seventeenfold decline in mean orthophosphate levels. (See also W80-02773) (Seigler-IPA)
W80-02804

LAKE REHABILITATION: A STATUS REPORT,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
S. M. Born.
Environmental Management, Vol 3, No 2, p 145-153, March 1979. 2 Fig, 2 Tab, 52 Ref.

Descriptors: *Lake rehabilitation, *Eutrophication, *Water quality, *Sedimentation, *Lakes, *Water management(Applied), Lake degradation, Resource management, Clean Lakes Act, Lake Washington(WA), Strategies, Natural resources, Water quality control, Water pollution.

The most prevalent lake degradation problems are the result of eutrophication and sedimentation; other problems are due to the addition of toxic substances and radio-activity and by man-made alterations. Lake rehabilitation activities have been centered in developed and populous countries in lake-rich parts of the world, particularly in Western Europe, Canada, and the United States. In the U.S. lake rehabilitation has been provided for by the Clean Lakes Act (Sec. 314, PL 92-500). There are two general approaches to rehabilitating lakes: (1) restricting the input of undesirable materials, and (2) employing in-lake controls for the removal or inactivation of undesirable materials. In-lake techniques that can be used to hasten the recovery of degraded lakes include dredging, nutrient inactivation/precipitation, and aeration and/or circulation. The Lake Washington, Seattle (WA) case represents one of the most conclusive and best documented lake rehabilitation experiences. The lake underwent rapid eutrophication due to the influx of sewage effluent beginning in 1941. Concern led to creation of a municipal sewerage authority in 1958; by 1972 the lake had been rehabilitated to pre-eutrophication conditions and it has continued to experience improved water quality. The most outstanding illustration of the potential for employing in-lake techniques in a comprehensive lake rehabilitation strategy is the restoration of Lake Trummen in Sweden. Most of the lake rehabilitation activities to date have dealt with eutrophication problems and have emphasized reducing nutrient loading, particularly phosphorous. (Iervolino-NC)
W80-02869

PERFORMANCE OF AN AXIAL FLOW PUMP FOR LAKE DESTRATIFICATION,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
J. E. Garton, R. G. Strecker, and R. C. Summerfelt.
Reprint from Southeastern Association of Game and Fish Commissioners, Thirtieth Annual Conference, p 336-346, 1976. 9 Fig, 1 Tab, 27 Ref, OWRT A-028-OKLA(4), 14-31-001-3236.

Descriptors: *Lakes, *Destratification, *Oklahoma, *On-site tests, Water quality control, Pumping, Pumps, Equipment, Dissolved oxygen, Water quality, Biochemical oxygen demand, Testing procedures, Water temperature, Density, Hydrogen ion concentration, Turbidity, On-site data collections, Axial flow pump.

A propeller pump was operated for 120 days on a lake of 40 ha surface area in north-central Oklahoma in the summer of 1975 to accomplish artificial destratification. The pump created a downflow of well-oxygenated surface water by means of a 1.82 m diameter propeller located 1.8 m below the lake's surface. The pump produced a flow of 1.72 cu m/sec, equivalent to 12.9% of total lake volume per day, at 17 rpm with a 1.0 h.p. electric motor. Four days of pumping eliminated thermal stratification, raised the temperature of the hypolimnetic water 9.5C, but increased surface temperature less than 1C. Thereafter, the entire water column remained isothermal (27-29C) during the summer. Dissolved oxygen at 5 m increased from 0.2 to 4.3 mg/l after the first day of pumping; thereafter DO levels at 5 and 9 m depths were above levels observed in 1973 and 1974; in mid-July 100% of the lake's volume contained more than 5 mg/l DO. BOD levels averaged 2.3 mg/l before pumping but 1.2 mg/l after pumping began. Turbidity did not change substantially with pumping, but vertically the variation at 1, 5, and 9 m depths was reduced. (Humphreys-ISWS)
W80-02879

EFFECT OF BOTTOM CONDITIONS ON EUTROPHY OF IMPOUNDMENTS,
Illinois State Water Survey, Urbana.
D. P. Roseboom, R. L. Evans, W. Wang, T. A. Butts, and R. M. Twait.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-137649, Price codes: A04 in paper copy, A01 in microfiche. ISWS Circular 139, 1979. 58 p, 34 Fig, 13 Tab, 34 Ref.

Descriptors: *Impoundments, *Eutrophication, *Illinois, *On-site investigations, Benthos, Lakes, Water chemistry, Water quality, Sediments, Oxygen demand, Water properties, Testing procedures, Hydrogen ion concentration, Analytical techniques, Methodology, Dissolved oxygen, Alkalinity, Iron, Manganese, Phosphorus, Ammonia, Anaerobic conditions, On-site data collections, On-site tests, Sampling, Water temperature, Sediment oxygen demand.

Two man-made impoundments, Lakes Eureka and Canton in central Illinois, were studied to develop procedures for assessing behavior characteristics and thereby relative eutrophy of waters in man-made lakes. Likenesses and differences for the two lakes in productivity, water chemistry, and sediment oxygen demand were identified. Both lakes thermally stratify and maintain an anerobic zone in bottom strata for a 5-month period in summer; stratification is weak in the shallower Lake Eureka, but well-defined in Lake Canton. The rate of anerobic zone formation is greater in Lake Eureka, but the zone's extent from the bottom is less than in Lake Canton; overall, oxygen depletion conditions in Lake Canton are the most severe. The thermal stratification of the lakes is not a barrier to the extent the anerobic zone penetrates the overlying waters. Both lakes support blue-green algae blooms. The density of algae at Lake Canton exceeds that at Lake Eureka; however, alkalinity reductions at the surface indicate algal productivity of Lake Eureka exceeds that of Lake Canton by 30%, and alkalinity increases in the bottom waters indicate microbial activity in bottom muds in Lake Eureka exceeds that in Lake Canton by 44%. Differences in alkalinity between the surface and bottom waters in both lakes were significant. Nonetheless, higher total and dissolved phosphorus contents in Lake Canton bottom waters give that lake a greater potential for productivity. Significant quantities of iron and manganese (mainly Fe(++) and Mn(++) forms) are released from the bottom muds of both lakes during summer stagnation. Chlorine demand of bottom waters is greater than that in upper water layers in both lakes.
W80-02881

A STATISTICAL ANALYSIS OF THE SEDIMENT VOLUME ACCUMULATED IN RESERVOIRS,
Asian Inst. of Tech., Bankok (Thailand).
For primary bibliographic entry see Field 2J.
W80-02890

HYDRAULIC POTENTIAL IN LAKE MICHIGAN BOTTOM SEDIMENTS,
Illinois State Geological Survey, Urbana.
K. Cartwright, C. S. Hunt, G. M. Hughes, and R. D. Brower.
Journal of Hydrology, Vol 43, No 1/4, p 67-78, October 1979. 6 Fig, 1 Tab, 11 Ref.

Descriptors: *Hydraulic properties, *Lake sediments, *Groundwater potential, *Groundwater movement, *Lake Michigan, Potentiometers, Groundwater, On-site investigation, Sampling, Sediments, Lakes, Hydraulic gradient, Measurement, Water chemistry, Hydrology, Sedimentology, Limnology, Hydraulic potential.

The magnitude and direction of groundwater flux in the bottom sediments of Lake Michigan were deduced from measurements made during three

shipboard cruises between 1973 and 1975. These factors affect the geochemical environment of the sediments and therefore the distribution of trace elements reported to be present. The near-shore, sandy-bottom and fine-grained, soft, deep-lake sediments were investigated; areas of hard till or bedrock were not included in the study. Thirty-three piezometers were placed in near-shore sands in waters 5-15 m deep. The piezometers were placed an average of 3 m into the bottom sediment. Water levels from the piezometers averaged 0.6 cm above the lake level, equivalent to an upward hydraulic gradient of about 0.002 cm/cm. Water samples taken from the piezometers have a distinctly different chemical composition from that of the lake water. The total dissolved mineral content and hardness of the groundwater are about twice those of the lake water. Twenty-two hydraulic gradient measurements were made in the fine-grained soft deep-lake sediments in waters 48-140 m deep by using a differential-pressure transducer dropped into the sediments. These measurements show an upward gradient averaging 0.2 cm/cm. No chemical data were obtained for the groundwater in the deep-lake sediments. The results of this study indicated that the groundwater flux is upward through the bottom sediments into Lake Michigan and that there is a chemical change in the water near the water-sediment contact. (Sims-ISWS)
W80-02893

HYDROGEOLOGY OF GLACIAL-TERRAIN LAKES, WITH MANAGEMENT AND PLANNING APPLICATIONS,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 2A.
W80-02895

CONCENTRATIONS OF BENZO(A)PYRENE IN THE SEDIMENTS OF SIX WESTERN UNITED STATES LAKES,
Department of Energy, New York. Environmental Measurements Lab.
For primary bibliographic entry see Field 5B.
W80-02898

MATHEMATICAL MODELING OF VEGETATIVE IMPACTS FROM FLUCTUATING FLOOD POOLS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
T. A. Austin, W. F. Riddle, and R. Q. Landers, Jr.
Water Resources Bulletin, Vol 15, No 5, p 1265-1280, October 1979. 9 Fig, 28 Ref, 1 Append. OWRT B-049-IA(3).

Descriptors: *Flood control, *Iowa, *Reservoir operation, *Vegetation effects, *Model studies, Mathematical models, Computer models, Reservoirs, Vegetation, Vegetation establishment, Flooding, Water levels, Water level fluctuations, Shores, Lakes, Biology, Shoreline vegetation, Vegetative succession.

A flood control reservoir protects valuable developments on the downstream floodplain by storing flood waters and releasing them at a rate that will reduce the downstream damage. The water surface level of the flood pool behind the dam can fluctuate considerably during the occurrence of a large magnitude flood causing severe impacts on shoreline vegetation and water based recreation facilities located in the flood pool. A mathematical simulation model describing shoreline vegetative succession in response to flooding was presented. Plant species were grouped into ecologically similar compartments. Differential equations describing compartment intrinsic growth, intraspecies competition, interspecies competition, and other growth limiting factors were solved numerically. The model was used to evaluate the impacts of various operating policies on plant succession for a new reservoir in Central Iowa. (Sims-ISWS)
W80-02916

2I. Water In Plants

AQUATIC PLANT HARVESTING AS A LAKE RESTORATION TECHNIQUE,
Michigan State Univ., East Lansing. Inst. of Water Research.
T. M. Burton, D. L. King, and J. L. Ervin.
In: Lake Restoration, Report No EPA 440/5-79-001, p 177-185, 1979. 1 Fig, 3 Tab, 86 Ref.

Descriptors: *Aquatic plants, *Harvesting, *Eutrophication, Biomass, Aquatic algae, Dissolved oxygen, Evapotranspiration, Lake sediments, Phosphorus, Nitrogen, Light penetration, Aquatic environment, Floating plants, Aquatic productivity, Lake stages, Recreation.

The potential of aquatic plant harvest for nutrient removal depends largely on nutrient loading levels. Loading levels must be low for plant harvesting to be a successful technique for lake restoration, however, it does provide recreation and fishing benefits. For a typical eutrophic northern U.S. lake, a plant harvest will remove 1.5g to 12g of N/sq m/yr while in a southern U.S. lake it will remove 4.5g to 19.5g of N/sq m/yr. The floating species such as hyacinths and duckweed are capable of producing larger harvests. An estimation of nutrient removal by a plant harvest can be calculated by estimating the known point source loading and the non-point source loading along with the density of harvestable macrophytes. Macrophyte density can be determine from aerial photographs and ground truth data. These values can then be used in an equation to determine whether or not a harvest will remove more phosphorus and nitrogen than is being added to the lake. Environmental impacts of plant harvesting include resuspension of surficial sediments, exudation from severed macrophytes, leaching from floating severed stems, increased light penetration, decreased evapotranspiration, increased erosion of the littoral zone, phytoplankton blooms, and changes in dissolved oxygen, sediment, and the general biotic community. Harvesting costs vary widely but are usually in the $200 to $300 per hectare range. (See also W80-02773) (Seigler-IPA)
W80-02800

2J. Erosion and Sedimentation

POTENTIAL OF PALYGORSKITE AS A SEDIMENT TRACER,
Georgia Univ., Athens. Dept. of Geology.
R. E. Carver, and L. S. French.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134331, Price codes: A03 in paper copy, A01 in microfiche. Environmental Resources Center Georgia Institute of Technology Atlanta, Report No ERC 05-79, May 1979. 30 p, 10 Fig, 5 Tab. OWRT B-133-GA(1), 14-34-0001-8075.

Descriptors: Water pollution, Soil erosion, *Sediment yield, *Tagging, *Sediment transport, Tracking techniques, Clays, *Palygorskite.

The object was to determine the potential of palygorskite as a sediment tracer. Soil samples from road cuts, construction sites, and borrow pits were analyzed for the size distribution and mineralogy of the fine fraction. The fine fraction was concentrated by wet sieving, and by removal of iron oxides and organic matter. The iron-oxide-free, organic-matter-free fine fraction (the clean fine fraction) ranged from 17.3 to 41.8 percent of the original weight of the five samples studied in detail. Palygorskite detection limits were determined by doping samples of clean fine fraction with 1, 5, 10, and 20 percent palygorskite (70 percent pure) and running X-ray diffractograms. One percent palygorskite was detectable in all samples, and 0.2 to 0.4 percent palygorskite in the original sample should be detectable in the clean fine fraction of the sample. Palygorskite appears to have excellent potential as a sediment tracer.
W80-02762

DREDGING AND LAKE RESTORATION,
Corvallis Environmental Research Lab., OR.
S. A. Peterson.
In: Lake Restoration, Report No EPA 440/5-79-001, p 105-144, 1979. 10 Fig, 4 Tab, 26 Ref.

Descriptors: *Dredging, *Eutrophication, *Lake sediments, Colloids, Desilting, Lakes, Lake basins, Lake beds, Watersheds(Basins), Lake stages, Bottom sediments, Nutrients, Dissolved oxygen, Toxins, Water temperature.

Of the techniques being used for lake restoration, dredging is the only one that directly removes the products of degredation (sediment) from the lake. It deepens the lake, removes recyclable nutrients, and returns the sediment to the watershed. Environmental concerns associated with dredging include resuspension of bottom sediments, toxic substances, oxygen depletion, reduced primary production, temperature alteration, increased nutrient levels, benthic community alteration, and sediment disposal sites. Negative and positive aspects are discussed for various types of dredging equipment including grab, bucket, clamshell, cutterhead, and specialized dredges such as mud cat, bucket wheel, and Japanese special purpose dredges. Results from dredging projects in several lakes are also discussed. Dredging costs are difficult to accurately determine because they depend on (1) the types and quantity of sediment to be removed, (2) type of dredges used, (3) the nature of the operational environment, and (4) the geographic location and method of material disposal. Corps of Engineer average dredging costs are presented for the various U.S. geographical areas. (See also W80-02773) (Seigler-IPA)
W80-02792

PHYSICAL AND CHEMICAL TREATMENT OF LAKE SEDIMENTS,
Notre Dame Univ., IN. Dept. of Civil Engineering.
T. L. Theis.
In: Lake Restoration, Report No EPA 440/5-79-001, p 115-120, 1979. 9 Fig, 1 Tab, 20 Ref.

Descriptors: *Eutrophication, *Lake sediments, *Phosphorus, *Cycling nutrients, Lakes, Lake stages, Bottom sediments, Salts, Sands, Dredging, Clays, Linings, Aeration, Fly ash.

The treatment of lake sediments by physical or chemical means is sometimes the best solution in eutrophic lakes experiencing slow recovery following the control of external nutrient sources. All sediment treatment techniques are designed to increase the role of sediments as nutrient (phosphorus) sinks and decrease their role as sources. Physical sediment treatments designed to cover sediments include physical liners, sand, and clay. Physical liners are usually a flexible plastic lining placed over sediments to prevent sediments from diffusing into the water. This method has been used in small reservoirs and lagoons, but its use on a large area is questionable as is its permanence and effect on benthic organisms. Sand is widely used due to its low cost, however, it does not provide a diffusion barrier. The use of layers of clay is promising, but clay has not yet been tested in lakes. Dredging, also a physical treatment, is effective but expensive. Dredging also often causes considerable deleterious environmental effects. Chemical treatment, the addition of chemical salts to sediments, alters sediment chemistry and increases those reactions that trap nutrients. Chemical treatment drawbacks include high chemical costs and the need for annual treatment. Fly ash shows promise as a treatment agent that can combine the benefits of both physical and chemical treatment. Hypolimnetic aeration, while not normally considered a sediment treatment can also reduce phosphate release rates. (See also W80-02773) (Seigler-IPA)
W80-02793

LAKE COCHRANE PERIMETER ROAD-SEDIMENT TRAPS RESTORATION PROJECT,
East Dakota Conservatory Sub-District, Brookings, SD.
J. L. Siegel.
In: Lake Restoration, Report No EPA 440/5-79-001, p 205-207, 1979. 3 Fig, 1 Tab, 3 Ref.

Descriptors: *Sediment control, *Multiple-purpose projects, *Suspended solids, South Dakota, Sedimentation, Eutrophication, Aquatic algae, Boat-launching ramps, Road construction, Fish management, Lakes, Lake stages, Lake sediments, Nutrients, Watersheds(Basins).

Lake Cochrane is one of the top 10 lakes in northeastern South Dakota. It is a high quality deep lake with intermittent surface water inflow, very infrequent surface outflow, and moderate groundwater recharge. An algal bloom in 1971 indicated that sediment nutrient inflow from three small drainage areas was adversely affecting the lake. An Environmental Protection Agency clean lakes grant was used to fund the construction of sediment traps as a part of the lake's perimeter road system. Features of the $35,000 multi-purpose project are: (1) 2,700 feet of gravel road to complete the perimeter road system; (2) three sediment traps to reduce inflow from 66% of the total dried drainage area; (3) a new boat access area; and (4) multi-purpose use of two of the traps as fish rearing ponds. Samples collected during the 1977 spring runoff indicated about an 80% removal of suspended solids by the sediment traps. Due to limited data collection and the concurrent impact of home construction around the lake, it is not possible to draw definite conclusions about the impacts of the project. (See also W80-02773) (Seigler-IPA)
W80-02803

A COMPARISON OF ELECTRONIC AND PIPET METHODS FOR MECHANICAL ANALYSIS OF SOILS,
Idaho Univ., Moscow. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 8D.
W80-02862

A STATISTICAL ANALYSIS OF THE SEDIMENT VOLUME ACCUMULATED IN RESERVOIRS,
Asian Inst. of Tech., Bankok (Thailand).
H. N. Phien, and A. Arbhabhrirama.
Journal of Hydrology, Vol 44, No 3/4, p 231-240, December 1979. 12 Ref.

Descriptors: *Sedimentation, *Reservoirs, *Reservoir silting, Reservoir storage, Dead storage, Statistical methods, Trap efficiency, Hydrology, Sediment discharge, Sediment trap efficiency.

A statistical method was used to investigate the reservoir sedimentation problem by: (1) correlating the annual sediment discharge and the annual river discharge; (2) using the resulting correlation either to generate a sediment sequence having the same length as the river discharge, or to obtain the distribution of the sediment discharge by means of a transformation of variable; and (3) expressing the accumulated volume as the cumulative sum of a sequence of random variables. Assuming a reservoir trap efficiency equal to unity, this cumulative sum is the partial sum of annual sediment discharges. The investigation then concentrated on the derivation of the mean and variance of the sediment volume accumulated in the design lifetime of the reservoir. (Lee-ISWS)
W80-02890

ON THE ORIGIN AND CHARACTERISTICS OF RIVER CHANNEL PATTERNS,
Sheffield Univ. (England). Dept. of Landscape Architecture.
For primary bibliographic entry see Field 2E.
W80-02891

HYDRAULIC POTENTIAL IN LAKE MICHIGAN BOTTOM SEDIMENTS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 2H.
W80-02893

OBSERVATIONS OF CONTEMPORARY ARROYO CUTTING NEAR SANTA FE, NEW MEXICO, U.S.A.
Geological Survey, Denver, CO. Geologic Div.; and Geological Survey, Reston, VA. Water Resources Div.
H. E. Malde, and A. G. Scott.
Earth Surface Processes, Vol 2, p 39-54, 1977. 13 Fig, 1 Tab, 16 Ref.

Descriptors: *Arroyos, *Channel erosion, *Rainfall-runoff relationships, *Semiarid climates, *New Mexico, Monitoring, *Arroyo cutting, *Santa Fe area(N Mex).

Arroyo cutting that began in the American Southwest in the 1880s is associated with sudden runoff, a circumstance characteristic of this semiarid region in which occasional intense rainfall exceeds the capacity of the ground to absorb water. This report describes two arroyos in an area of moderately dissected bolson deposits southwest of Santa Fe, Canada de la Cueva and Pueblo Canon, where arroyo cutting since 1970 has been closely related to runoff from summer rain. The area is vegetated chiefly by grama grass and scattered juniper. Cutting is monitored by repeated surveys of channel floors, cross-sections, and headcuts, and by repeated photographs taken as stereopairs. Rainfall and discharge are measured simultaneously in 5-minute intervals by dual digital recorders at a gauging station on Canada de la Cueva (drainage area 4.64 square kilometers). Discharge has been as much as 18.2 cubic meters per second from rainfall of 25.2 millimeters. (Woodard-USGS)
W80-02932

2K. Chemical Processes

AN ANOMALOUS OCCURRENCE OF SODIUM BICARBONATE WATER IN A FLOOD PLAIN IN A CARBONATE TERRANE,
Indiana Univ. at Bloomington. Dept. of Geology.
N. C. Krothe, and R. R. Parizek.
Ground Water, Vol 17, No 6, p 595-603, November-December 1979. 6 Fig, 4 Tab, 8 Ref, OWRT A-005-PA(10).

Descriptors: *Water chemistry, *Streams, *Sediments, *Pennsylvania, Soil water, Sodium compounds, Calcium, Magnesium, Potassium, Sampling, Chemical analysis, Flood plains, Chemistry, Sodium bicarbonate.

Geochemical factors controlling water chemistry in an influent stream and adjacent flooplain sediments were determined during a four-year study. The stream has a drainage basin that is similar to many streams draining carbonate terranes in the eastern United States. The stream receives sewage effluent and farm and urban runoff and supplies recharge to an aquifer under extensive development. Water beneath the floodplain, springs, and channel were calcium bicarbonate as expected; however, the prevalent chemical character of soil water beneath the channel was sodium bicarbonate. HC03(-) within soil water beneath the stream is three times (1,500 mg/l) that beneath the floodplain, Na(+) is two orders of magnitude greater (400 mg/l), K(+) reaches 10 mg/l, which is twice as great, while Ca(2+) and Mg(2+) may be 1/5 as high as concentrations beneath the floodplain, with ranges from 15 to 20 mg/l and 5 to 10 mg/l, respectively. Waters 3 to 7 feet below the floodplain contain intermediate Na(+) values from 25 to 75 mg/l. Ion exchange appears to be the mechanism accounting for the sodium bicarbonate water observed under the channel. The same relationship should occur in other areas with available carbonate rock, base exchange minerals, and an organic source. (Sims-ISWS)
W80-02880

EFFECT OF BOTTOM CONDITIONS ON EUTROPHY OF IMPOUNDMENTS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2H.
W80-02881

ERROR ANALYSIS APPLIED TO INDIRECT METHODS FOR PRECIPITATION ACIDITY,
California Inst. of Tech., Pasadena. Dept. of Environmental Engineering Sciences.
H. M. Liljestrand, and J. J. Morgan.
Tellus, Vol 31, No 5, p 421-431, October 1979. 10 Fig, 31 Ref.

Descriptors: *Precipitation(Atmospheric), *Acidity, *Rain water, *Water chemistry, Chemistry of precipitation, Rainfall, Hydrogen ion concentration, Ions, Cations, Chemicals, Conductivity, Data processing, Analytical techniques, Acid precipitation, Rainfall acidity, Indirect methods, Error analysis.

The historical increase in the acidity of precipitation in northern Europe has been monitored by direct measurements of pH and titrations of acidity. Indirect methods such as conductivity and charge balances as well as chemical source models have been used to confirm the measured acidities. In the absence of historical records of direct measurements of acidity in precipitation in the United States, indirect methods have been applied to available data on the composition of rainwater to quantify the acidity. Unfortunately, the indirect methods are sensitive to small errors in certain pH regions. The effects of random errors in major ion concentrations as well as the systematic errors due to the exclusion of trace metal and organic ions were shown to be largest around pH 5.6 in the charge balance and chemical source strength calculations and largest around pH 6.1 for the conductivity balance method. Estimates of the uncertainty in historical mean values of precipitation ion concentrations were used to calculate upper and lower bounds on the acidity of rainwater in the United States before 1970. The trend of increasing acidity of precipitation in the northeastern United States is still evident after applying error analysis. (Sims-ISWS)
W80-02887

A FLOW PATTERN DEDUCED FROM URANIUM DISEQUILIBRIUM STUDIES FOR THE CENOMANIAN CARBONATE AQUIFER OF THE BEERSHEVA REGION, ISRAEL,
Tel Aviv Univ., (Israel). Dept. of Geophysics and Planetary Sciences.
For primary bibliographic entry see Field 2F.
W80-02889

GROUND-WATER LEVELS AND QUALITY DATA FOR GEORGIA, 1978,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-02931

2L. Estuaries

FINITE ELEMENT MODEL OF 2-D STRATIFIED FLOW,
Rosensteil School of Marine and Atmospheric Science, Miami, FL.
J. D. Wang.
Journal of the Hydraulics Division. American Society of Civil Engineers, Vol 105, No HY12, Proceedings Paper 15049, p 1473-1485, December 1979. 9 Fig, 11 Ref, 2 Append, NSF ENG-77-06437.

Descriptors: *Estuaries, *Salinity, *Finite element analysis, *Mathematical models, *Saline water intrusion, Dispersion, Stratified flow, Fluid mechanics, Analytical techniques, Open channel flow, Velocity, Rivers.

A finite element model for the study of hydrodynamics and salt transport in partially-mixed estuaries was presented. The model is based on the laterally integrated time varying equations of motion, continuity, and conservation of salt. The Boussinesq approximation was applied to the resulting two-dimensional equations, and a simple equation of state was used to relate salinity to density. Although a rigorous mathematical proof cannot be given, it was heuristically postulated that the correct boundary conditions, defining a well-posed problem, must consist of applied stresses or strain rates in cases which include internal (Reynolds) stresses. Without the internal stresses, the pressure

or the normal strain rate only can be prescribed. A simple application demonstrated the ability of this model to accurately represent the moving surface. Another example illustrated the significance of ocean boundary conditions on the internal solution. (Adams-ISWS)
W80-02911

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

NORTH AMERICAN WATER TRANSFERS: AN OVERVIEW,
Biswas and Associates, Ottawa (Ontario).
For primary bibliographic entry see Field 6E.
W80-02870

3C. Use Of Water Of Impaired Quality

THE ATTITUDES OF INDUSTRY AND PUBLIC OFFICIALS ON INDUSTRIAL USE OF RECLAIMED MUNICIPAL WASTEWATER EFFLUENT IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
J. Pratte, and W. Litsky.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133606, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of Massachusetts, Publication No 106, 1979. 82 p, 1 Fig, 10 Tab, 43 Ref, 4 Append. OWRT A-114-MASS(1), 14-34-0001-9023.

Descriptors: *Water reuse, *Water conservation, *Industrial water, *Attitudes, Massachusetts, Waste water.

A study was initiated to assess the acceptance and capability of renovated wastewater supplying water to certain Massachusetts industries. The investigation was to determine if wastewater reuse by industry was a suitable water conservation measure in terms of social, economic, institutional and technological feasibility. Personal interviews, guided by a questionnaire, were held with industrial and public sector individuals. The results indicated that industry is more accepting of wastewater reuse than water resource officials if a project is cost-effective. Although there are few suitable industrial recipients of reclaimed water in Massachusetts, the concept is worthy of more attention as water costs increase, sewage treatment plants are upgraded and alternative water supplies are sought. (Godfrey-Mass)
W80-02707

WATER REUSE AND RECYCLING VOLUME 2: EVALUATION OF TREATMENT TECHNOLOGY.
Culp/Wesner/Culp, El Dorado Hills, CA.
For primary bibliographic entry see Field 5D.
W80-02711

SECONDARY SALINIZATION AND SODICATION IN EGYPT: A CASE STUDY,
Alexandria Univ. (Egypt).
For primary bibliographic entry see Field 5G.
W80-02858

3D. Conservation In Domestic and Municipal Use

TURNING 'WASTE' WATER INTO 'NEW' WATER,
L. Freeman.
Water, No 28, p 19-20, September 1979. 1 Fig.

Descriptors: *United Kingdom, *Water delivery, *Pipes, *Leakage, *Water loss, Islands, Water supply, Pipelines, Water conservation, Water shortage, Frequency, Ultrasonics, Water conveyance, Water districts, Conduits, Water management(Applied).

New methods for leak detection are being used on the Isle of Wight in an attempt to provide an additional 5 megaliters of water to the already inadequate supply. The island has a water demand that doubles during the summer due to vacationers. It is estimated that currently 1/4 of the island's water supply is being wasted due to leakage. The Southern Water Authority is using Hydrotronics Limited, a specialist in highly technological leak location to assist in identification of problem areas for a four week trial period. Hydrotronics uses a mobile laboratory and a 'black box' which includes microphone signal amplifiers and oscillographs. The box can operate in any of three frequency bands to identify leak noises. The equipment is accurate enough to find a leak and to determine the size of the hole. Approximately 17 miles of water lines were examined during the 4 weeks and 11 leaks were found that were wasting about 169,000 gallons of water. Although the Hydrotronics equipment is too expensive for the Water Authority to purchase it is considered highly successful. It is hoped that the island will be able to use the equipment again to help reduce waste to its lowest possible level by April of 1981. (Seigler-IPA)
W80-02755

INCREASING WATER AND SEWER RATE SCHEDULES: A TOOL FOR CONSERVATION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
R. S. McGarry, and J. M. Brusnighan.
Journal of the American Water Works Association, Vol 5, No 71, p 474-479, September 1979. 6 Tab.

Descriptors: *Water conservation, *Water rates, *Water consumption, *Water demand, *Water use, Water resources planning, Water quantity, Washington(DC), Rate structures, Building code, Surcharge, Water supply.

This article discusses how the Washington, D.C. Suburban Sanitary Commission (WSSC) began achieving the goal of water conservation by instituting increasing water and sewer rate schedules. Serving 1.2 million people in a 1,000 square mile section of Prince Georges and Montgomery Counties, MD, WSSC is an independent regional commission responsible for planning, financing and constructing water supply-sewer facilities for the area. Faced with projected growth in demand for nearby Potomac River water from 415 million gallons/day (mgd) in 1980 to 855 mgd in 2020, the Commission began its conservation program by revising the building code to require water-conserving toilets and pressure reducing water valves in all new construction and renovation. New water and sewer rates were levied which initially included an additional 20% surcharge during peak use months of June through September. Although residential customers comprise 91% of WSSC's users, they account for only 48% of water demand, and thus a differential rate structure imposing special rates on commercial users has resulted in some water savings. After new increased rates were imposed across the board, the summer surcharge was dropped. The new rates have resulted in an 8% drop in consumption for 1978 over 1977, although commercial consumption by large users remained unchanged. Unless these users begin to conserve, the rate schedules will again have to be restructured. (Arnold-NC)
W80-02857

3E. Conservation In Industry

INCREASING WATER AND SEWER RATE SCHEDULES: A TOOL FOR CONSERVATION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 3D.
W80-02857

3F. Conservation In Agriculture

IRRIGATION WATER USE AND MANAGEMENT.
Interagency Task Force Report of the Department of Interior, the Department of Agriculture, and the Environmental Protection Agency, June 1979. 140 p, 24 Fig, 22 Tab, 62 Ref.

Descriptors: *Irrigation water, *Water loss, *Irrigation efficiency, *Water conservation, Return flow, Irrigation practices, Agriculture, Crop production, Evapotranspiration, Irrigation ditches, Water conveyance, Water management(Applied), Seepage, Water utilization.

Irrigation water use and management are assessed and recommendations for increased conservation and efficiency are presented. Agricultural irrigation accounts for 80% of all consumed water and it is this area that has the most potential for savings. It is estimated that up to $5 billion is needed to implement water conservation techniques in the next 30 years. This should result in 2 to 5 million acre-feet of water that will become available for other uses. Improvements are possible in the areas of reducing (1) seepage from conveyance systems, (2) on farm irrigation return flows, and (3) incidental water uses. It is recommended that the individual States organize site-specific studies so that the conservation measures can be implemented. Federal programs will provide technical and financial assistance. The individual States have expressed their position of retaining control of their water resources and that the newly proposed programs should not be considered a substitute for the currently ongoing programs. The recommendations included are consistent with the President's June 6, 1978 water policy statement. A glossary of irrigation terms used in the report is also presented. (Seigler - IPA)
W80-02743

SECONDARY SALINIZATION AND SODICATION IN EGYPT: A CASE STUDY,
Alexandria Univ. (Egypt).
For primary bibliographic entry see Field 5G.
W80-02858

ON-FARM WATER MANAGEMENT IMPROVEMENT PROGRAMS,
Water Management and Irrigation Technologies Research Inst., Cairo (Egypt).
M. Abu-Zeid.
Water Supply and Management, Vol 3, No 2, p 69-75, 1979.

Descriptors: *Water resources, *Irrigation, *Water management(Applied), *Farm management, *Nile River(Egypt), Administration, Farming, Irrigation practices, Decision-making, Economics, Assessment, Water demand, Food production, Farms.

Irrigation for agriculture is the most effective means for rapidly increasing crop production. Traditionally, development of irrigation systems has involved new projects or enlarging existing projects with emphasis on capital intensive components. Water management in agriculture involves manipulation of water in the production of food and fiber; it is how to use all available tools and resources to provide water for plant growth. There is a major need for improvement of existing systems in order to improve management for rapid increase in food production, improve return of investments for existing systems, reduce costly waterlogging and salinity problems, reduce need for large capital investments in new systems and to gain knowledge which can provide criteria for the development and management of other systems. Water management programs consist of several overlapping phases; the four most important are (1) priority problem identification; (2) search for problem solutions; (3) assessment of solutions; and (4) pilot project implementation. The essential components for each phase are farmer participation and involvement; communication and feedback between farmers and researchers; effective, interdisciplinary team collaboration; careful selection, training and evaluation of all personnel; institutions

developed to serve farmers; and monitoring and evaluation of all aspects and phases. As an example of a management program the author describes the Egyptian Water Use and Management Project which was needed because the Aswan High Dam modified the Nile River fluctuations which served as coordination for prior water management systems. (Iervolino-NC)
W80-02864

IRRIGATION MANAGEMENT FOR RIVER-SALINITY CONTROL,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5G.
W80-02908

EVAPOTRANSPIRATION UNDER DEPLETING SOIL MOISTURE,
Kasetsart Univ., Bangkok (Thailand).
For primary bibliographic entry see Field 2D.
W80-02909

RETRACTING AGRICULTURAL IRRIGATION SPRINKLER,
P. Unruh.
U.S. Patent No 4,171,775, 6 p, 5 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 865, October 23, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance.

A retracting agricultural irrigation sprinkler is buried with its cylinder below ground so that its riser can extend above the ground for sprinkler irrigation of the adjacent ground. The principal parts which move during irrigation sprinkling, with the rotating sprinkler nozzle and the motor which drives it, are above the ground so that they are accessible for replacement without need for excavation down to the buried retraction cylinder. A seal is provided in the upper end of the buried cylinder so that dirt is prevented from penetrating into the cylinder during sprinkling, and during retraction of the riser, water is discharged at the seal to wash off the riser as it is drawn into the cylinder. A check valve prevents the entrance of ground water into the sprinkler system and its supply pipe when the sprinkler is not in use. (Sinha - OEIS)
W80-02997

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY: EXECUTIVE SUMMARY,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
W. G. Characklis, F. J. Gaudet, F. L. Roe, and P. B. Bedient.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116205, Price codes: A08 in paper copy, A01 in microfiche. Report No EPA-600/2-79-050a, July 1979. 148 p, 42 Fig, 29 Tab, 62 Ref. 802433.

Descriptors: *Urban runoff, *Watersheds(Basins), *Texas, *Storm runoff, Water quality control, Urban drainage, Urbanization, Eutrophication, Hydrologic data, Model studies, Water sampling, Disinfection, Paving, Nutrients, Overland flow, Chemical analysis, Pesticides.

Seventeen storms were monitored in six watersheds in the Houston, Texas, area during 1975 and 1976 to evaluate the physical, chemical, and biological effects of the water management plan used for the Woodlands, an ecologically planned community. The Woodlands water management plan is designed to avoid adverse water quality and hydrologic effects caused by urbanization. A comprehensive sampling and analytical program was used that monitored various chemical parameters including nitrogen, phosphorous, dissolved oxygen, pH, specific conductance, and chlorinated hydrocarbons. Also monitored were indicator bacterial organisms and aquatic and edaphic algae. for stormwater runoff, disinfectant demand and algal bioassays were conducted. Using the relationships between stormwater runoff quality, land use, and runoff quantities, the Stormwater Management Model (SWMM) was expanded to allow for separate sewer systems, urbanization effects on base flows, economics of natural drainage systems, Kjeldahl nitrogen, nitrates, and phosphates for a natural drainage system. The model was then used to simulate stormwater runoff quality and quantity for watersheds. Extensive results on the Woodlands system and SWMM are provided including the following: The greatest producers of suspended solids and nutrient loads are urban watersheds, urban stormwater runoff contains higher bacterial concentrations than forested area runoff, excessive does of chlorine or ozone are required for effective stormwater runoff disinfection from an urban area, and lakes serve as effective traps for excessive sediments transported by construction site runoff. (Seigler-IPA)
W80-02724

THE WHITE CLAY LAKE MANAGEMENT PLAN,
Wisconsin Univ. Extension, Madison.
J. O. Peterson, F. W. Madison, and A. E. Peterson.
In: Lake Restoration, Report No EPA 440/5-79-001, p 215-219, 1979. 1 Fig, 4 Tab, 5 Ref.

Descriptors: *Agricultural runoff, *Agricultural watersheds, *Watershed management, Wisconsin, Watersheds(Basins), Lakes, Eutrophication, Water management(Applied), Dairy industry, Farms, Water pollution sources, Farm wastes, Phosphorus, Domestic animals, Nitrogen.

Agricultural operations in the 3,500 acre White Clay Lake Watershed were studied in 1973 to determine their effect on lake water quality. White Clay Lake, located in eastern Shawano County, Wisconsin, has little shore development to contribute to lake eutrophication. Study operations included: (1) flow monitoring of three watershed areas; (2) water sampling for residue, phosphorus, nitrogen, and chloride content; (3) a groundwater movement and quality survey; and (4) the collection of weather data from stations within the watershed. Following the study a Lake Protection District and management plan were developed to reduce the nutrient and sediment flow into the lake. The plan emphasizes the protection of the lake rather than its restoration. The most critical nonpoint source pollution problems were barnyards and feedlots. Use of initial funding from the Upper Great Lakes Regional Commission, the U.S. Environmental Protection Agency, and the Wisconsin Department of Natural Resources was directed at the critical problems. Conservation practices were also installed on watershed croplands. White Clay Lake is now considered to be of good quality, however, monitoring is continuing to determine the effect of the preventive measures. (See also W80-02773) (Seigler-IPA)
W80-02805

SPECIAL FLOOD HAZARD INFORMATION: WOLF CREEK, GRANADA, COLORADO.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-02848

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER & TRIBUTARIES, GREAT BEND, KANSAS.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-02849

SPECIAL FLOOD HAZARD INFORMATION: CLEARWATER CREEK, RICE CREEK WATERSHED, CENTERVILLE, LINO LAKES, HUGO, MINNESOTA.
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 2E.
W80-02850

SPECIAL FLOOD HAZARD INFORMATION: GYPSUM AND DRY CREEKS, WICHITA, KANSAS.
Army Engineer District, Tulsa, OK.
For primary bibliographic entry see Field 2E.
W80-02851

SPECIAL FLOOD HAZARD INFORMATION REPORT: SANDY LICK CREEK, CITY OF DUBOIS, CLEARFIELD COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2E.
W80-02852

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER, ANDERSON AND KING ARROYOS, LA JUNTA, OTERO COUNTY, CO.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-02854

SPECIAL FLOOD HAZARD INFORMATION: CIBOLO CREEK, PRESIDIO & SHAFTER, TEXAS.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-02855

EXPANDED FLOOD PLAIN INFORMATION STUDY: ROWLETT CREEK, DALLAS AND COLLIN COUNTIES, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W80-02856

FLOOD HAZARD INFORMATION: SAN MARCOS AND BLANCO RIVERS, SAN MARCOS, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W80-02872

FLOOD PLAIN INFORMATION: MISSOURI RIVER, BISMARCK-BURLEIGH COUNTY, NORTH DAKOTA.
Army Engineer District, Omaha, NE.
For primary bibliographic entry see Field 2E.
W80-02873

SYNTHETIC DRAIN ENVELOPE-SOIL INTERACTIONS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 4D.
W80-02907

METHOD FOR SIPHONING WATER FROM A PONDING AREA ON A FLAT ROOF,
D. W. Loftin.
U S Patent No 4,171,706, 7 p, 5 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 840, October 23, 1979.

Descriptors: *Patents, *Rain water, Roofs, Ponding, Water conveyance, *Siphons, *Water removal, Flat roofs.

A method for removing water from a ponding area of a flat roof having a run-off system which is not longer operable to drain water from the ponding area comprises directing a quantity of the run-off water flow as a result of the commencement of a rain condition or the like into a priming chamber Run-off water is allowed to discharge into the run-off system at a rate less than the rate of flow of

run-off water into the priming chamber and effects a siphoning action. The quantity of run-off water flowing into the priming chamber is less than the quantity flowing out thereby lowering the water level within the priming chamber and creating a suction action which is utilized to commence the movement of the water in the ponding area through the siphon device hose. The movement continues until all of the water in the ponding area has been sucked up through the siphone hose. (Sinha - OEIS)
W80-02912

WATER ALLOCATION AND MANAGEMENT IN THE SOUTHEAST,
North Carolina State Univ. at Raleigh; and North Carolina Univ. at Chapel Hill.
D. H. Howells.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR2, p 259-267, September 1979. 2 Ref. OWRT B-125-NC(5), 14-34-0001-8134.

Descriptors: *Water allocation(Policy), *Water management(Applied), *Water rights, *Water transfer, *Land management, Water resources, Diversion, Water law, Water control, Southeastern U.S.

Summarized are papers and presentations associated with the April 19-20, 1978 Southeast Conference on Legal and Administrative Systems for Water Allocation and Management held at the Virginia Polytechnic Institute and State University in Blacksburg, Va. Conclusions and recommendations developed at the conference included: the need for reexamination of existing legal and administrative systems for water allocation to meet emerging problems in most southeastern states; legislation to clarify water rights associated with diversion and interbasin transfer; recodification of existing water law; studies and proposals leading to improved state policies, law, and programs with respect to minimum streamflows, water shortages, hydrologic and land use relationships. Conference was also placed on the need for strengthened state water resources planning, management, and interstate cooperation. (Bell-Graf--Cornell)
W80-02917

DEVICE FOR SIPHONING WATER FROM A PONDING AREA ON A FLAT ROOF,
D. W. Loftin.
U.S. Patent No 4,171,709, 12 p, 8 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 841, October 23, 1979.

Descriptors: *Patents, *Rain water, Roofs, Ponding, *Siphons, Conveyance structures, Water conveyance, Equipment, *Water removal, Flat roofs.

An apparatus for removing water from a ponding area of a flat roof having a run-off system which is no longer operable to drain water comprises a structure for directing a quantity of the run-off water flowing as a result of the commencement of a rain condition or the like into a priming chamber. The structure for displacing water from the priming chamber back into the run-off system works in such a way as to establish a negative pressure condition within the priming chamber. The structure communicates the negative pressure condition to the end of a siphon hose at a vertical level below the level of the ponding area. The other end of the siphon hose is placed in water sucking relation to the ponding area to thereby prime the siphon hose and commence the flow of water. The water flow continues until the rain condition ceases or until the water is substantially removed from the ponding area. (Sinha - OEIS)
W80-02979

MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY, STORM WATER RUNOFF QUALITY: DATA COLLECTION, REDUCTION AND ANALYSIS,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
W. G. Characklis, F. J. Gaudet, F. L. Roe, and P. B. Bedient.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116213, Price codes: A06 in paper copy, A01 in microfiche. Report No EPA-600/2-79-050b, July 1979, 112 p, 28 Fig, 25 Tab, 27 Ref, 802433.

Descriptors: *Urban runoff, *Hydrologic data, *Texas, *Storm runoff, Urban drainage, Urban hydrology, Watersheds(Basins), Land use, Water quality, Water pollution sources, Overland flow, Water sampling, Sedimentation rates, Environmental effects, Data collection.

Storm water runoff quality was studied at several sites in the Houston, Texas, metropolitan area including the Woodlands, an ecologically planned community designed to utilize existing natural drainage while reducing adverse water quality and hydrologic effects resulting from urbanization. The Storm Water Management Model was used at the Woodlands to combine water quality and quantity data for design and management purposes. Features of the Woodlands include reclaimed waste water impoundments for dry weather irrigation and non-contact recreation and porous pavement to reduce runoff volumes. Water quality and quantity data were collected during both dry and storm conditions for the following parameters: organic carbon, biochemical oxygen demand, ammonia, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphates, total phosphorus, dissolved oxygen, pH, turbidity, total suspended solids, and specific conductance. From the data, pollutant loads were predicted according to land use. Results show that total pollutant load-runoff relations are a function of land use activity in a watershed. It was found that man-made lakes do serve as effective traps for sediments from construction site runoff. Extensive results and conclusions are presented along with recommendations for continued assessment of the planned water resources system at the Woodlands. (Seigler-IPA)
W80-02996

4B. Groundwater Management

GROUND-WATER RESOURCES AND MODEL APPLICATIONS FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER IN THE SAN ANTONIO REGION, TEXAS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W80-02883

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--PACIFIC NORTHWEST REGION,
Geological Survey, Seattle, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-02928

4C. Effects On Water Of Man's Non-Water Activities

EFFECTIVE LOCAL AUTHORITY TO ENSURE LASTING LAKE RESTORATION AND PROTECTION,
Westlake Lake Management Association, CA.
F. Bigelow.
In: Lake Restoration, Report No EPA 440/5-79-001, p 33-38, 1979. 5 Ref.

Descriptors: *Water management(Applied), *Urban hydrology, *Administration, California, Community development, Planning, Lakes, Recreation, Eutrophication, Lake stages, Lake basins, Lake shores, Public rights, Insurance, Taxes, Operating costs, Operation and maintenance, Maintenance costs.

The management structure and methods of the Westlake Lake Management Association are outlined. The 150-acre lake was constructed in 1967 for a residential community. It drains 18 square miles of runoff, has 700 homes along the nine mile shoreline, and another 700 homes off the lake. A 33 member general board of directors elects a smaller executive board which meets monthly. The covenant, conditions, and restrictions (CG and R's) document, carefully drawn up to guide the management, requires a two-thirds majority vote of all home owners to change any rules. The CC & R's document spells out management policy and association rules in the areas of assessments for lake maintenance fees, construction of docks, landscaping and property maintenance, methods of enforcing violations, rights and obligations of homeowners, authority to hire a manager and staff, and various structural rules for the organization. Other problems of lake management discussed include tax exempt status, operating insurance, and communication with association members. Public meetings and a monthly newsletter with a question and answer section are suggested as ways to educate lake association members and to keep them aware of management actions. Other areas of special management consideration are lake maintenance, operation requirements, and watershed management. Effective planning to reduce and prevent unnecessary management and maintenance costs should involve exchanges of information with other lake associations, local, county, state, and Federal agencies, research centers, and universities. (See also W80-02773) (Seigler-IPA)
W80-02779

THE IMPACT OF SURFACE MINING ON THE HYDROLOGIC ENVIRONMENT OF THE BIG SANDY CREEK WATERSHED, FAYETTE COUNTY, PENNSYLVANIA,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
K. K. Sheaffer.
In: Surface Mining and Fish/Wildlife Needs in the Eastern United States, Report No FWS/OBS-78/81 A, p 91-98, 1979. 2 Fig, 4 Tab, 2 Ref.

Descriptors: *Pennsylvania, *Coal mines, *Environmental effects, *Watershed management, Water sampling, Monitoring, Fish, Benthos, Alkalinity, Water temperature, Sediments, Rainfall, Iron, Specific conductivity, Dissolved oxygen, Stream gauges, Flow measurement.

Stony Fork, the major tributary of Big Sandy Creek, was monitored to establish a base for determining the effects of bituminous surface mining on the watershed. There are already three active surface mines in the watershed with much interest for expanded mining. Monitoring methods used include chemical, physical, and biological sampling on a continuous, weekly, monthly, and semi-annual sampling basis. Two surface water gauging stations continuously monitor stream flow quantity. Also monitored are pH, temperature, specific conductance, dissolved oxygen, rain amounts, sediment, suspended solids, alkalinity, acidity, total and dissolved iron, and total and dissolved levels of 14 metals. Sampling was performed quarterly for benthic macroinvertebrates and fish identification. Summaries of results are presented for March through September 1977. Overall results indicate that no measurable change has occurred in Stony Fork water quality. The data collected form a sufficient base for the evaluation of present and future bituminous surface mining impacts. (Seigler-IPA)
W80-02809

POTENTIAL INTERACTIONS BETWEEN PIPELINES AND TERRAIN IN A NORTHERN ENVIRONMENT,
Department of the Environment, Ottawa (Ontario). Inland Waters in Directorate.
R. O. van Everdingen.
Ottawa, Ontario, Canada NHRI Paper No 8, 1979. 7 p, 1 Tab, 6 Ref.

Descriptors: *Pipelines, *Natural gas, *Construction, Terrain, Berm mode, Buried mode, Operation, Abandonment, Groundwater, Surface-water, Abandonment.

In a northern environment various interactions between pipelines and the terrain which they cross may produce adverse effects on pipeline integrity;

adverse effects on the environment may also result, either directly or as a consequence of the increased maintenance or repairs required. In any particular situation the interactions and the severity of their effects will depend on the pipeline construction mode (e.g. buried or above-ground) and operation mode (e.g. chilled or warm); on the distribution of frozen and nonfrozen ground; and on the relative sensitivity of the ground during freezing and/or thawing. Most of the interactions are related to the occurrence and movement of surface water and subsurface water or to the occurrence or formation of ice. A tabulation of possible interactions and effects is presented as a guide to the potential problems that may occur during the construction and operation, as well as after abandonment, of a pipeline. When recognized early enough, development of such problems can often be avoided by rerouting or prevented by special design measures. Early recognition can in most cases only be achieved through special studies on groundwater levels, flow rates and temperatures; on the occurrence of icings; and on the distribution and character of ground ice. (WATDOC)
W80-02833

4D. Watershed Protection

SYNTHETIC DRAIN ENVELOPE-SOIL INTERACTIONS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
L. S. Willardson, and R. E. Walker.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR4, Proceedings Paper 15028, p 367-373, December 1979. 2 Fig, 4 Tab, 7 Ref.

Descriptors: *Drainage, *Sediments, *Filters, Soil properties, Soil physics, Soil structure, Laboratory tests, Permeameters, Hydraulic gradient, Subsurface drainage, Tile drainage, Interfaces, Earth-water interfaces, Sedimentation, Sediment transport, Sediment control, Drain envelopes, Soil interactions.

Synthetic drain envelope materials currently available commercially have been found to be equally effective as drain envelopes. The materials function primarily as mechanical support for the soil-drain opening interface. Soils have a limited characteristic resistance to internal hydraulic gradients. Flows causing gradients in excess of the hydraulic failure gradient of the particular soil will result in failure of the soil structural skeleton and the drain envelope. (Sims-ISWS)
W80-02907

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

FISH BIOASSAY MONITORING OF WASTE EFFLUENTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
W. H. Van Der Schalie, K. L. Dickson, G. F. Westlake, and J. Cairns.
Environmental Management, Vol 3, No 3, p 217-235, 1979. 5 Fig, 7 Tab, 68 Ref.

Descriptors: *Industrial wastes, *Bioassay, *Fish behavior, *Sunfishes, Virginia, Toxins, Respiration, Water pollution, Monitoring, Industrial water, Water pollution sources, Fish physiology, Chemical wastes, Waste water(Pollution).

An on-line evaluation of a computer-based fish monitoring system was conducted to determine the system's value in monitoring the toxicity of industrial waste effluents. Bluegills, Lepomis macrohirus Raf., were used in the study. The monitoring site was on the New River at Pearisburg, Virginia, at the Celanese Fibers Company's Celco Plant. At the site, plant wastes averaged 0.1% of the total river flow. The computerized system monitored the ventilation patterns of 12 bluegills in individual fiberglass tanks containing 30 liters of water. Electrical signals generated when a fish passes water over its gills were detected by stainless steel electrodes located at each end of a tank. Wastewater was passed into the tanks to simulate various conditions in eight experiments. A control fish was used for all experiments. One experiment included the simulation of an acetone spill. Many problems and inconsistencies were encountered due to environmental disturbances and system design problems, however, the technique shows much potential. Recommendations concerning the physical components and computer software for a second generation monitoring system are provided. A brief history of previously developed monitoring systems is also presented. (Seigler-IPA)
W80-02744

METHODS OF EVALUATION OF POTENTIALLY HAZARDOUS ORGANICS IN WATER,
Connecticut Univ., Storrs. Inst. of Water Resources.
R. P. Collins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-135122, Price codes: A02 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1979. 13 p, 1 Tab, 11 Fig. OWRT A-072-CONN(1), 14-34-0001-8007.

Descriptors: *Gas chromatography, *Mass spectrometry, Water analysis, Analytical techniques, *Organic pollutants, Trace organic pollutants.

A method for 'fingerprinting' of public water supplies for the presence of trace organic pollutants has been devised. The procedure involves the trapping of organic compounds on Tenax GC columns, desorption of the compounds from the column and analysis by gas chromatography. A systematic procedure has also been devised for the characterization of trace organic pollutants in the Thames River. The process involves solvent extraction, separation into classes of organic compounds, and identification by means of gas chromatography and mass spectrometry. (Burke-Conn)
W80-02761

MUNICIPAL POLLUTANT LOADINGS TO THE GREAT LAKES FROM ONTARIO COMMUNITIES,
Environmental Protection Service, Ottawa (Ontario). Water Training and Technology Transfer Div.
D. H. Waller, and Z. Novak.
Canada-Ontario Agreement on Great Lakes Water Quality, Ottawa, Ontario, Canada, Research Report No 94, 1979. 40 p, 4 Fig, 17 Tab, 18 Ref, 75-8-33.

Descriptors: *Great Lakes, *Municipal wastes, *Water pollution, Pollutants, Sewage, Pollutant loads, Human population, Land use, Surface runoff, Ontario.

This report updates and extends previous estimates of total annual pollutant loads to the Great Lakes from Ontario communities. An improved method of estimating combined sewage loads is proposed and evaluated. (WATDOC)
W80-02832

WATER QUALITY INTERPRETIVE REPORT, ONTARIO, 1967-1977.
Water and Earth Science Associates Ltd., Ottawa (Ontario).
Available from Inland Waters Directorate, Environment Canada, Ottawa, Ontario, Canada, K1A OE7. Water Quality Interpretive Report No 3, 1979. 67 p, 17 Fig, 25 Tab, 17 Ref, 1 App.

Descriptors: *Water quality, *Water quality control,*Water treatment, *Potable water, Watersheds(Basins), Water types, Chemical analysis, Geochemistry, Data collections.

The chemical data for 27 watersheds in Ontario have been reviewed and interpreted. During the period 1967 to 1977, over 1600 samples were collected and chemically analysed for as many as 30 water quality parameters. The Ontario data base considered in this report contains more than 37000 data points. Analysis of the major ion chemistry indicated that most of the Ontario watersheds were alkaline-earth bicarbonate waters. Three were designated alkaline-earth bicarbonate/sulphate waters, and one was alkaline-earth sulphate water. Anthropogenic loadings were evident in six watersheds in the St. Lawrence Lowland region. These watersheds exhibited higher ionic proportions of both chloride and sulphate. Although no water quality assessment was possible for the protection of freshwater aquatic life, the extreme susceptibility of the Precambrian watersheds, especially the watersheds on the Laurentian Highlands, to environmental alteration was very evident. (WATDOC)
W80-02838

LEACHING OF POLLUTANTS FROM SANITARY LANDFILL MODELS,
Technion-Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 5B.
W80-02905

SIMPLIFIED DIURNAL CURVE ANALYSIS,
Hickok (Eugene A.) and Associates, Inc., Wayzata, MN.
For primary bibliographic entry see Field 5B.
W80-02913

CONTAMINATION OF THE MEDITERRANEAN BLUE AND WHITE DOLPHIN BY ORGANOCHLORINE COMPOUNDS (IN FRENCH),
Institut Scientifique et Technique des Peches Maritimes, Nantes (France).
C. Alzieu, and R. Duguy.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 331-334, 1979. 2 Tab, 3 Ref.

Descriptors: *Pesticide residues, *Marine fish, Polychlorinated Biphenyls, DDT, DDD, DDE, Chemical analysis, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Toxicity, Growth Stages, *Dolphins, *Stenella, *Tissue analysis, *Bioaccumulation, *Mediterranean Sea.

The contamination levels of PCB, DDT and metabolites were analysed in tissue of 22 dolphins, Stenella coeruleoalba, stranded on the Mediterranean coast of France. The organochlorine content was higher in the blubber and liver than in the other organs. The immature animals, and particularly a new born animal were more contaminated than the adults. Certain observations suggest that the health of the dolphin may be endangered if PCB level in the liver exceeds 20 mg/kg of dry frozen tissue. (Deal-EIS)
W80-02940

THE TEMPERATURE AND OXYGEN LETHAL LIMITS OF ACARTIA CLAUSI GIESBRECHT IN A POLLUTED MARINE ECOSYSTEM,
Athens Univ. (Greece). Dept. of Zoology.
C. Yannopoulos.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 359-363, 1979. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Water temperature, *Oxygen requirements, *Copepods, Thermal stress, Water chemistry, Dissolved oxygen, Biomass, Annual, Seasonal, Salinity, Zooplankton, Statistical analysis, *Acartia.

The temperature and oxygen lethal limits, in vivo, of the copepod Acartia clausi, have been estimated in the Elefsis Bay marine ecosystem where environmental conditions seem to be extremely favourable for the growth of this species only. Temperature Upper Lethal limits may be considered to be between 20.7 to 22.1 C and Oxygen Low Lethal limits to be about 3.20 ml O2/l H2O. However, because oxygen concentrations are primarily de-

pendent on water temperature, it can be concluded that oxygen must have a synergistic effect, together with temperature, rather than a direct influence on the decline of this species during the warm period of each year. (Deal-EIS)
W80-02941

STUDIES IN REGARD TO DIFFERENT TYPES OF ACTION OF DETERGENTS ON MARINE SPECIES (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
G. Bellan, R. Kaim-Malka, A. Ladjal, G. Stora, and S. Tahvildari-Damoui.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 411-415, 1979. 2 Tab, 17 Ref, (English summary).

Descriptors: *Detergents, *Surfactants, *Toxicity, *Bioassay, Laboratory Tests, Benthos, Polychaetes, Molluscs, Crustaceans, Echinoderms, Mortality, Water pollution effects, Methodology.

Action in vitro of detergents on benthic marine invertebrates has been studied during 9 years. Every stage of life cycle and every metabolitic functions may be altered by these pollutants. These studies permit also to explain better the different sensibility of species to pollutants. The results obtained in standing water tests are similar to those obtained on flowing water tests. Detergents used in bioassay tests were anionic and non-ionic. The toxicity of various commercial detergents was determined as was the effect on their development. Anatomical and cellular changes were observed. (Katz-EIS)
W80-02944

EFFECTS OF THE DEFOLIANT 2-4-5-T ON THE DINOFLAGELLATE PROROCENTRUM MICANS IN CULTURE (IN FRENCH),
Arago Lab., Banyuls-sur-Mer (France).
F. De Billy.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 431-434, 1979. 2 Fig.

Descriptors: *Toxicity, Mortality, *Phytoplankton, Water pollution effects, *Bioassay, Laboratory tests, Diatoms, Plant Pathology, Plant physiology, Herbicides, Growth, Growth inhibition, Defoliant 2-4-5-T.

A dose of 40 micro Moles/1 of 2-4-5-T causes a lethal reaction in a culture of Prorocentrum micans. The growth inhibition is inversely proportional to the concentration of 2-4-5-T. A total inhibition is attained at a dose higher than 300 micro Moles/1. Electron microscopic observation indicates changes in the intracellular organelles both in the cytoplasm and the nucleus. (Katz-EIS)
W80-02945

LETHAL AND SUBLETHAL EFFECTS OF MERCURY SALTS ON MONODONTA ARTICULATA,
Royal Univ. of Malta, Valletta. Dept. of Biology.
L. J. Saliba, V. Schembri, and M. G. Vella.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 319-323, 1979. 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Mercury, *Toxicity, *Mollusks, Chlorides, Sulfates, Oxygen requirements, Animal physiology, Animal behavior, Salts, Chemical properties, Bioassay, *Mercury compounds, *Acetates.

The comparative toxicity of mercuric acetate, chloride and sulphate to Monodonta articulata Lamarck is described. Effects of sublethal concentrations of the three salts on immersion/emersion behaviour, interface activity, and aquatic oxygen consumption are investigated. Emersion periods generally increase, and immersion and activity periods decrease with rises in mercury concentration. All three salts reduce aquatic oxygen consumption at levels of 0.01 ppm Hg ++, consumption decreasing further with rises in concentration. Mercuris sulphate exhibits the greatest overall effect. (Deal-EIS)
W80-02946

NOXIOUS EFFECTS OF DIESEL OIL D-2 AND THE SYNERGISTIC EFFECT OF POLYCHLORINATED BIPHENYLS (AROCLOR 1242) ON ZOOPLANKTON SPECIES EURYDICE TRUNCATA,
Biological Inst., Dubrovnik (Yugoslavia).
F. Krsinic, D. Vilicic, M. Picer, and N. Picer.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 307-312, 1979. 2 Fig, 4 Ref.

Descriptors: *Oil, *Polychlorinated biphenyls, *Toxicity, *Isopods, Zooplankton, Bioassay, Mortality, Aroclors, Fuels, Gas chromatography, Animal physiology, Animal behavior, Phytoplankton, *Eurydice.

Preliminary research has been performed on the influence of Diesel oil D-2 and the synergistic effect of Aroclor 1242 on the isopod Eurydice truncata. The organisms were maintained in glass cylinders at constant temperature and light-dark cycle. They were fed a mixture of phytoplankton cultures (Skeletonema costatum and Cryptomonas sp.). Polluting substances were added to the system in the form of emulsion after being shaken for 30 minutes in natural sea water. Diesel oil D-2 was added in the following concentrations: 0.01 ppm, 0.1 ppm, 015 ppm, 1 ppm, 5 ppm and 10 ppm. Aroclor 1242 was always in a concentration of 0.2 ppb. The control of polluting substance concentration in the system was performed by means of the E. C. gas chromatography and spectrofluorometry. At a concentration of 10 ppm Diesel oil in the course of 48 hours the mortality was rather high in all tested organisms, while at concentrations less than 1 ppm no mortality effects were registered even after the addition of Aroclor 1242. (Deal-EIS)
W80-02947

NEW DATA ON THE DISTRIBUTION OF POLLUTANTS AND THEIR EFFECT ON SOME HYPONEUSTON CONSTITUENTS IN THE S.E. MEDITERRANEAN,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
M. L. El-Hehyawi.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 301-305, 1979. 2 Fig, 4 Tab, 4 Ref.

Descriptors: *Oil pollution, *Heavy metals, *Zooplankton, Oil, Oil Spills, Organic compounds, Seasonal, Coasts, Spectrophotometry, Beaches, *Zinc, *Cadmium, *Mercury, *Lead, Fish eggs, Chemical analysis, *Tar balls, *Hyponeuston, *Mediterranean Sea, *Egypt.

Pollution in the shallow waters of the S.E. Mediterranean was found to have a detectable influence in some restricted localities. But in the open sea waters it had little effect upon the hyponeustonic organisms. The main problem coming from oil pollution is the accumulation of the hydrocarbons and tar balls on some beaches under the influence of the north-westerly winds. In addition, the very poor zooplankton abuandance in the oil drilling area in Abu-Qir Bay may reveal that measures for protection against effective hydrocarbons are inadequate. The mercury content of the meroplankton organisms and the species Euterpina, was detected in relatively high concentration levels in the Eastern Harbour. The zooplankton abundance and the fish eggs in the hyponeuston layer varied within a wide range (2.0-500.0 counts/sqm) according to the environmental conditions. It was difficult to differentiate between the effect of the pollutants and other factors except in south-western part of Abu-Qir Bay. (Deal-EIS)
W80-02948

BIOACCUMULATION FROM WATER AND ELIMINATION OF VANADIUM IN SELECTED MARINE INVERTEBRATES,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
P. Miramand, J. C. Guary, and S. W. Fowler.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique se la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 277-279, 1979. 4 Ref.

Descriptors: *Path of pollutants, *Invertebrates, *Metals, Absorption, Sorption, Radiochemical analysis, Tracers, Water temperature, Salinity, Worms, Mussels, Shrimp, Crabs, Animal metabolism, Geochemistry, *Vanadium, *Depuration, *Bioaccumulation.

Radiotracer experiments using 48V were designed to follow the bioaccumulation from sea water and elimination of vanadium in four invertebrates common to the Mediterranean. Uptake appeared to be essentially a physical sorption phenomenon which was little affected by temperature. Loss, on the other hand, was enhanced at elevated temperatures. Vanadium accumulation was inversely proportional to salinity over a range from 38% to 19%. Radioisotope loss from shrimp was unaffected by salinity; in the case of mussels, there was a slight tendency for increased loss at low salinities. Patterns of loss as well as biological half-times varied with species. Molting was found to be particularly effective in removing incorporated vanadium from crustaceans. The casting of molts is considered to be an important link in the marine biogeochemical cycle of vanadium. (Deal-EIS)
W80-02952

COMPARISON BETWEEN THE HG BODY BURDEN OF THYNNUS THYNNUS FROM THE MEDITERRANEAN AND THE ATLANTIC,
Siena Univ. (Italy). Lab. di Idrobiologio.
A. Renzoni, M. Bernhard, R. Sara, and M. Stoeppler.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 255-260, 1979. 4 Fig, 1 Tab, 13 Ref.

Descriptors: *Mercury, *Fish physiology, *Absorption, Heavy metals, Size, Chemical analysis, Length, Atlantic Ocean, Water pollution sources, Path of pollutants, Fish migrations, Spawning, *Tuna, *Tissue analysis, *Bioaccumulation, *Mediterranean Sea.

Mercury body burden was determined in tuna specimens of different sizes from the Italian coast and the Strait of Gibraltar. Specimens from about 20 cm length to 250 cm showed a strong and significant increase of Hg concentration with length. Tunas greater than 250 cm had much lower (1/4) body burdens. Their Hg/length correlations is weak. The differences in the Hg body burden are explained by assuming that the tunas with higher body burdens are from the Mediterranean and the ones with lower body burdens from the Atlantic. The latter migrate into the Mediterranean only for spawning. The higher Hg body burden in the Mediterranean tuna is due to the higher than average natural environmental level in the Mediterranean. This higher environmental level has its origin in the geochemical Hg anomaly of the Mediterranean basin. Similar results were obtained in other pelagic fishes. (Deal-EIS)
W80-02954

FLUORIDE IN ANTARCTIC KRILL (EUPHAUSIA SUPERBA) AND ATLANTIC KRILL (MEGANYCTIPHANES NORVEGICA),
Havforskningsinstitutt, Bergen (Norway). Inst. of Vitamin Research.

T. Soevik, and O. R. Braekkan.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1414-1416, 1979. 2 Tab, 9 Ref.

Descriptors: *Fluorides, *Path of pollutants, Animal metabolism, Animal physiology, Crustaceans, Chemical properties, Commercial shellfish, Public health, Chemical analysis, *Krill, *Prawns, *Red feed, *Tissue analysis, *Bioaccumulation, *Bioavailability.

Samples of Antarctic krill (Euphausia superba) and Atlantic krill (Meganyctiphanes norvegica) were analyzed for fluoride using a selective fluoride electrode method. Both species showed very high concentrations, a total of 1330-2400 mg F/kg, on fat free dry weight basis in raw samples whereas deep sea prawns (Pandalus borealis) showed a total of 18-91 and red feed (Calanus finmarchicus) 10-37 mg F/kg. Sections of Antarctic krill were analyzed, and the highest concentration was found in the carapace, 4260 mg F/kg fat free dry matter, compared with 570 and 750 mg F/kg in raw and boiled muscle. Biological availability was measured in a chick assay, and showed fluoride in krill to be equally utilized as sodium fluoride added to the diet. (Deal-EIS)
W80-02957

TEMPERATURE INFLUENCE ON BASAL ACTIVITY AND INDUCTION OF MIXED FUNCTION OXYGENASE ACTIVITY IN FUNDULUS HETEROCLITUS,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
J. J. Stegeman.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1400-1405, 1979. 2 Tab, 30 Ref.

Descriptors: *Killifishes, *Enzymes, *Animal metabolism, *Water temperature, Biochemistry, Fish physiology, Bioassay, Inhibition, Mode of action, Toxicity, Proteins, *Benzo(a)pyrene, Carcinogens.

Treatment of Fundulus heteroclitus acclimated to 6.5C with benzo(a)pyrene did not elicit any change in the levels of hepatic microsomal NADH- or NADPH-cytochrome c reductase activity, nor in the levels of cytochrome P-450 or its catalytic activities. However, the same treatment of fish at 16.5C resulted in a marked induction of benzo(a)pyrene hydroxylase and NADPH-cytochrome c reductase. Cytochrome P-450 content was also higher in the warm, treated fish and the Soret maximum of reduced, CO-treated microsomes was shifted to the violet. Levels of aminopyrine demethylase and NADH-cytochrome c reductase activities did not show a significant treatment effect. At neither temperature could treated and control fish be distinguished on the basis of in vitro inhibition of benzo(a)pyrene hydroxylase activity by 7,8-benzoflavone. Levels of NADPH-cytochrome c reductase and benzo(a)pyrene hydroxylase activities were greater in control Fundulus acclimated to 6.5C than to 16.5C, when normalized to microsomal protein, but not when based on body weight. The results indicate that habitat temperature alone may not affect the capacity for initial hydrocarbon metabolism in fish, but that it can strongly influence the induction of cytochrome P-450. (Deal-EIS)
W80-02958

FISH AND DAPHNIA TOXICITY AS SURROGATES FOR AQUATIC VASCULAR PLANTS AND ALGAE,
Dow Chemical Co., Midland, MI. Health and Environmental Sciences.
E. E. Kenaga, and R. J. Moolenaar.
Environmental Science and Technology, Vol 13, p 1479-1480, 1979. 2 Tab, 4 Ref.

Descriptors: *Toxicity, *Chemical wastes, *Bioindicators, Methodology, Chlorella, Daphnia, Aquatic plants, Aquatic algae, Minnows, Carp, Shiners, Chemical properties, Organic compounds, Industrial wastes, Bioassay, Mortality, Water quality standards.

The relative degree of acute toxicity of thousands of chemicals of heterogeneous structures was compared for fishes, daphnids, aquatic vascular plants, and algae. Aquatic animals were more sensitive indicators of toxic effects than were plants or algae. Compounds that were toxic at under 1 ppm for daphnids, fishes, aquatic vascular plants, and algae represented 2.4, 1.3, 0.12, and 0.02%, respectively, of the total tested for each of these four groups of organisms. Of the 27,781 chemicals tested on aquatic plants and 49,082 tested on the alga Chlorella, all but 3 compounds were either not toxic to these organisms under 1 mg/l, or were toxic to fish and Daphnia at 1 ppm or less. (Deal-EIS)
W80-02960

EXAMINATION OF PHOSPHORUS CYCLING AND CONTROL OF PHYTOPLANKTON DYNAMICS IN LAKE ONTARIO WITH AN ECOLOGICAL MODEL,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
D. Scavia.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1336-1346, 1979. 8 Fig, 2 Tab, 66 Ref.

Descriptors: *Lake Ontario, *Mathematical models, *Phytoplankton, *Phosphorus, Nutrients, Seasonal, Biomass, Zooplankton, Calcium carbonate, Epilimnion, Chemical properties, Food webs, Diatoms, Crustaceans, Copepods, Great Lakes

An ecological model of Lake Ontario was used to assist in interpretation of data collected during the International Field Year for the Great Lakes (March 1972-April 1973). The analysis indicated that in spring and fall phytoplankton biomass is controlled by the interaction of incoming solar radiation and vertical mixing, in summer by silica- and phosphorus-limitation, and in late summer by zooplankton grazing. The influence of CaCO3 precipitation on the light climate in late summer was also demonstrated. During the period of stratification, available phosphorus concentration is controlled by recycling within the epilimnion, primarily through plant and animal excretion. Comparison of simulated available phosphorus concentrations and concentrations of total dissolved phosphorus and soluble reactive phosphorus in the epilimnion suggest that the composition of the soluble unreactive phosphorus pool changes dramatically during the year and that the large pool of dissolved unavailable phosphorus during summer is composed of end products of material cycled several times through the food web. (Deal-EIS)
W80-02962

HEAVY METALS IN THE NATIVE OYSTER (OSTREA ANGASI) AND MUSSEL (MYTILUS EDULIS PLANULATUS) FROM PORT DAVEY, SOUTH-WESTERN TASMANIA,
Tasmanian Fisheries Development Authority, Taroona.
J. D. Thomson.
Australian Journal of Marine and Freshwater Research, Vol 30, p 421-424, 1979. 1 Tab, 13 Ref.

Descriptors: *Heavy metals, *Oysters, *Mussels, Zinc, Cadmium, Copper, Lead, Chemical analysis, Water quality standards, Public health, Spectrophotometry, Water pollution sources, *Australia, *Tissue analysis, *Bioaccumulation.

Oysters and mussels were sampled from Port Davey in winter 1975 and summer and winter 1978. The permissible concentration for zinc provisionally recommended by the National Health and Medical Research Council was exceeded in oysters, and the standard for lead was exceeded in both mussels and oysters in the 1975 sample. Port Davey is isolated and virtually uninhabited and the metals derive from natural sources. (Deal-EIS)
W80-02963

ENTRAINMENT AND IMPINGEMENT OF FISH BY POWER PLANTS IN THE GREAT LAKES WHICH USE THE ONCE-THROUGH COOLING PROCESS,
Fisheries and Marine Service, Sault Ste. Marie (Ontario). Great Lakes Biolimnology Lab.
J. R. M. Kelso, and G. S. Milburn.
Journal of Great Lakes Research, Vol 5, No 2, p 182-194, 1979. 9 Fig, 5 Tab, 20 Ref.

Descriptors: *Fish populations, *Mortality, *Entrainment, Powerplants, Cooling waters, Intakes, Great Lakes, Commercial fish, Toxicity, Bass, Carp, Perches, Seasonal, *Impingment, *Clupeids.

There are 89 thermal electric generating stations, producing 54,118 Megawatts (Mwe) of electricity, which use water directly from the Great Lakes. These power plants require almost 2000 m3s-1 of cooling water or, conservatively, 30% of the flow of the St. Lawrence River. Impingement of fish is directly related to power plant size and we calculated that more than 100,000,000 fish will be lost at existing and proposed stations. Impingement results in direct losses to the fishery of more than 25%, by weight, of the annual commercial fish harvest. Entrainment is also directly related to power plant size and we expect more than 1.28 time 10 to the 9th power larval fish will be lost by entrainment. These estimates of entrainment and impingement are conservative since they are based upon rated pumping capacity, not actual usage which was 67% for the few plants that provided this information. Impingement losses, when combined with entrainment losses which will affect recruitment to some unknown degree, likely constitute a significant undersirable impact upon the Great Lakes fishery. (Deal-EIS)
W80-02965

FLUXES OF DISSOLVED AND PARTICULATE CALCIUM IN SELECTED TISSUES OF CRASSOSTREA VIRGINICA,
Delaware Univ., Lewis. Marine Studies Complex.
For primary bibliographic entry see Field 5B
W80-02966

EFFECTS OF TEMPERATURE ON THE GROWTH AND SURVIVAL OF THE EUROPEAN EEL, ANGUILLA ANGUILLA L.,
Central Electricity Generating Board, Ratcliffe-on-Soar (England). Freshwater Biology Unit.
K. Sadler.
Journal of Fish Biology, Vol 15, p 499-507, 1979. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Eels, *Water temperature, *Growth rates, Heated water, Cooling waters, Thermal pollution, Powerplants, Aquiculture, Toxicity, Animal behavior, Mortality, Fish physiology, Animal metabolism.

Experiments to determine the growth rate of eels at different temperatures are described and show the optimum temperature for growth to be 22-23C. The ultimate upper lethal temperature was found to be 38C and the critical thermal maximum varied from 33 to 39C for fish acclimated at 14 to 29C. An attempt was also made to determine lower lethal temperatures. Eels enter a state of torpor at temperatures varying from 3C for fish acclimated at 29C to less than 1C for fish acclimated at 23C or below. The results have been used to estimate the growth rates expected from eels cultured in power station cooling water using different types of temperature control. (Deal-EIS)
W80-02968

MERCURY CONTENT OF SHARK FROM SOUTH-WESTERN AUSTRALIAN WATERS,
Western Australia Dept. of Fisheries and Fauna, Perth. Marine Research Labs.
N. Caputi, J. S. Edmonds, and D. I. Heald.
Marine Pollution Bulletin, Vol 10, p 337-340, 1979. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Mercury, *Sharks, *Commercial fish, Path of pollutants, Heavy metals, Chemical analysis, Spectrophotometry, Size, Length, Trophic level, Regression analysis, *Tissue analysis, *Bioaccumulation, *Australia.

Muscle samples from four species of commercially sought shark (Thickskin, Carpet, Hammerhead and Grey Nurse) have been analyzed for total mercury.

The standard flameless atomic absorption spectrophotometric techniques were used. As with other predatory and longlived species of fish, such as tuna and black marlin, these four species of shark accumulate substantial quantities of mercury. Mercury concentration was found to be related to the length of the fish. Mean mercury levels for large individuals of all species was over 1.0 ppm. (Deal-EIS)
W80-02972

MAJOR DETOXIFICATION PATHWAYS FOR PENTACHLOROPHENOL IN GOLDFISH,
Kyushu Univ., Fukuoka (Japan). Lab. of Fisheries and Chemistry.
K. Kobayashi, and N. Nakamura.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 9, p 1185-1188, 1979. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Animal metabolism, *Organic compounds, *Path of pollutants, Fish physiology, Chemical properties, Chemical reactions, Biochemistry, Sulfates, Absorption, Biodegradation, *Pentachlorophenol(PCP), *Goldfish, *Tissue analysis, *Bioaccumulation, Detoxification.

A study was made to demonstrate the contribution of the branchial, renal, and biliary routes to the PCP excretion in goldfish, Carassius auratus, and also to determine the importance of the sulfate and glucuronide conjugations as the detoxification mechanisms for PCP in the fish. The amounts of PCP excreted from the branchial, renal, and biliary routes corresponded to approximately 52, 24, and 22% of the total amount of PCP (approx. 5 micromol) excreted by the fish (av. 68g) for 24h after 24-h exposure to 0.1 ppm PCP. The excretion of PCP from the body surface was negligibly small compared with that from the above three routes. Approximately 30% of the PCP excreted from the gills was in a free-form, whereas almost all the PCP excreted in both of the bile and urine was in a conjugated-form. The total amount of the sulfate conjugate excreted in the surrounding water and the urine was ca. 3 micromol, while that of the glucuronide in the bile was ca. 1 micromol. However, a considerable amount of the PCP-glucuronide in the bile was hydrolyzed by the intestinal mucus of fish. This indicates that the glucuronide conjugation is not so important as compared with the sulfate conjugation to eliminate PCP from the fish body, because the PCP released from the glucuronide in the intestine must be reabsorbed there. (Deal-EIS)
W80-02973

A CULTURE STUDY OF SALINITY RESPONSES IN ECOTYPES OF TWO ESTUARINE RED ALGAE,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.
C. Yarish, P. Edwards, and S. Casey.
Journal of Phycology, Vol 15, p 341-346, 1979. 5 Fig, 4 Tab, 14 Ref.

Descriptors: *Salinity, *Habitats, *Rhodophyta, Bioassay, Laboratory test, Growth rates, Adaptation, Cycles, Algae, Estuaries, Growth stages, Salt tolerance, Metabolism.

Laboratory culture studies on the euryhalinity of Bostrychia radicans and Caloglossa leprieurii from the mouth and head of the Mullica River estuary, New Jersey, revealed both species probably have ecotypes whose growth patterans correlate with the salinity regime of their habitat in nature. Significant growth differences of tetrasporelings were determined in response to four salinities (5, 15, 25, 35%) even after acclimation periods of the tetrasporophytes from 6 mo-2 yr in laboratory culture. However, one isolate of Bostrychia and both isolates of Caloglossa also demonstrated some capability for physiological adaptation to salinity changes although this was less significant statistically than their ecotypic response. It thus appears that certain euryhaline algae may consist of ecotypes, each of which has some capacity for physiological adaptation to salinity variations. (Deal-EIS)
W80-02974

EFFECTS OF ARSENIC SPECIATION AND PHOSPHATE CONCENTRATION ON ARSENIC INHIBITION OF SKELETONEMA COSTATUM (BACILLARIOPHYCEAE),
Skidaway Inst. of Oceanography, Savannah, GA.
J. G. Sanders.
Journal of Phycology, Vol 15, p 424-428, 1979. 3 Fig, 26 Ref.

Descriptors: *Arsenic compounds, *Inhibition, *Productivity, *Diatoms, Absorption, Metabolism, Algae, Growth rates, Phosphorus, Phosphates, Nutrient requirements, Chemical properties, *Arsenic, *Arsenate, *Skeletonema.

Arsenate is taken up readily by Skeletonema costatum due to its chemical similarity to phosphate, and it inhibits primary productivity at concentrations as low as 67 nannoM when the phosphate concentration is low. A phosphate enrichment of greater than 0.3 microM alleviates this inhibition; however, the arsenate stress causes an increase in the cell's requirement for phosphorus. Arsenate is also toxic to Skeletonema at similar concentrations. Methylated species, such as dimethylarsinic acid, did not affect cell productivity at the levels examined. Thus, the reduction and methylation of arsenate to dimethylarsinic acid by the cell produces a stable, non-toxic compound. (Deal-EIS)
W80-02975

VITAMIN B12-BINDER AND OTHER ALGAL INHIBITORS,
Yale Univ., New Haven, CT. Dept. of Biology.
I. J. Pintner, and V. L. Altmeyer.
Journal of Phycology, Vol 15, p 391-398, 1979. 8 Fig, 3 Tab, 14 Ref.

Descriptors: *Vitamins, *Metabolism, *Algae, *Inhibitors, Diatoms, Dinoflagellates, Cyanophyta, Chlorophyta, Chrysophyta, Chemical properties, Inhibition, Biochemistry, Proteins, Growth rates, Marine algae, Aquatic algae, *Vitamin B12.

Euglena gracilis, Poterioochromonas malhamensis, Monochrysis lutheri, Isochrysis galbana and Phaeodactylum tricornutum are known to release into the medium a substance which binds free vitamin B12. Culture filtrates of selected marine diatoms, chrysophytes, cryptophytes, dinoflagellates and green algae contained the binder, indicating that binder release was not restricted to any algal group. Production increases with density of the culture and is not restricted to stationary or scenescent cells. The marine species tested produced much less B12 than the freshwater Euglena and Poterioochromonas; the inhibition is reversed by 20-50 ng/l of B12 for marine species which reach moderate densities and by 150-300 ng/l B12 for the densely growing species. Consequently the binder may affect the growth of B12-requiring species only in environments like the open ocean poor in B12. By contrast, the marine algae produce other inhibitors which are often heat stable and very inhibitory. (Deal-EIS)
W80-02977

EFFECTS OF THREE OIL SPILL DISPERSANTS ON MARINE BACTERIAL POPULATIONS. I. PRELIMINARY STUDY. QUANTITATIVE EVOLUTION OF AEROBES,
Aix-Marseille-1 Univ. (France). Lab. de Microbiologie du Milieu Marin.
D. Marty, A. Bianchi, and C. Gatellier.
Marine Pollution Bulletin, Vol 10, p 285-287, 1979. 3 Tab, 7 Ref.

Descriptors: *Oil spills, *Marine bacteria, Oil, Oil pollution, Organic compounds, Bacteria, Growth rates, Aerobic bacteria, Aquatic populations, Water pollution treatment, Oil-water interfaces, *Dispersants, *Corexit, *Crude oil.

The effects of three hydrocarbon dispersant agents (Corexit 9527, Hydrogamosol LT and OSR LT 126) on the bacterial flora of the marine environment are analysed in 20-square-metre basins filled with lagoon seawater. Four months after the first treatment, oil slicks were no longer visible, whereas the appearance of the untreated reference slick had hardly changed. The treatment of 10-litre crude-oil slicks causes an appreciable and long lasting increase in the bacterial population. (Deal-EIS)
W80-02978

TOXICITY OF SOLUBLE COPPER AND OTHER METAL IONS TO ELODEA CANADENIS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
B. T. Brown, and B. M. Rattigan.
Environmental Pollution, Vol 13, p 303-314, 1979. 6 Fig, 3 Tab, 31 Ref.

Descriptors: *Toxicity, *Copper, *Aquatic plants, Methodology, Analytical techniques, Metals, Ions, Inhibition, Phytosynthesis, Herbicides, Mode of Action, Bioassay. *Elodea.

A procedure for observing the effects of dissolved copper and other metal ions on the submersed aquatic macrophyte Elodea canadensis has been described. Metal concentrations have been determined which inhibit light-induced oxygen evolution from plant segments after short-term exposure (24th), and which produce phytotoxicity in whole plants over a longer period (28 days). These results are discussed in terms of the phytotoxic effects on Elodea resulting from dissolved metal ions present in polluting concentrations in natural water bodies or from the use of added copper as an aquatic herbicide. (Deal-EIS)
W80-02980

DISTRIBUTION OF ESSENTIAL AND TOXIC METALS IN THE TERRESTRIAL GASTROPOD ARION ATER,
University Coll. of Wales, Aberystwyth. Dept. of Zoology.
M. P. Ireland.
Environmental Pollution, Vol 13, p 271-278, 1979. 4 Tab, 32 Ref.

Descriptors: *Trace elements, *Metals, *Gastropods, Magnesium, Lead, Zinc, Manganese, Calcium, Phosphates, Cadmium, Copper, Path of pollutants, Soil chemistry, Absorption, Animal metabolism, *Arion, *Tissue analysis.

A study was made of the metal concentrations in the gastropod Arion ater at two sites. In whole animals, all metals analysed, except magnesium, were higher in concentration at the Cwmystwyth site where high amounts of lead, zinc and manganese but low concentrations of calcium and phosphate were found in vegetation. Individual tissues analyses showed high concentrations of magnesium, zinc, cadmium and phosphate in digestive gland and high concentrations of calcium in digestive gland and mantle. Lead and copper did not concentrate to any extent in a specific tissue. Manganese was located mainly in mantle, skin and foot. Mucus secreted from Cwmystwyth slugs contained high amounts of zinc and manganese, and granules isolated from the digestive gland, more zinc. Both extracts contained less calcium and magnesium than extracts from campus slugs. The results are discussed in relation to metal concentrations in vegetation and soil together with excretion and uptake mechanisms. (Deal-EIS)
W80-02981

EFFECTS OF SALINITY ON THE RESPIRATION AND HEART RATE OF THE COMMON MUSSEL, MYTILUS EDULIS L., AND THE BLACK CHITON, KATHERINA TUNICATA (WOOD),
Louisiana State Univ., Baton Rouge.
W. B. Stickle, and T. D. Sabourin.
Journal of Experimental Marine Biology and Ecology, Vol 41, p 257-268, 1979. 2 Fig, 3 Tab, 31 Ref.

Descriptors: *Salinity, *Toxicity, *Respiration, *Mussels, Animal physiology, Wanimal metabolism, Oxygen requirements, Mollusks, Salt tolerance, Cycles, Adaptation, Fluctuations, Mytilus, *Chiton, *Heart rate.

The rate of oxygen consumption of stepwise acclimated mussels increased linearly from 30 10 o/oo

salinity (S) while that of Katherina tunicata was not significantly different between 10 and 30 o/oo S. Heart rate was 21-22 and 17-18 beats/m2 in M. edulis and K. tunicata, respectively, and no difference was found in the heart rate of either species acclimatedstepwise to 10, 20 or 30 o/oo S. The average oxygen consumption rate of M. edulis exposed to 12 h, 30-10 - 30 and 10-30-10 o/oo S cycles of fluctuating salinity was significantly lower than the respective control rate: there was a similar response during the 30-10-30 o/oo S cycle in K, tunicata. The respiration rate of M. edulis and K. tunicata declined as salinity deviated from the control salinity and increased as salinity returned to the control salinity. The rate of oxygen consumption by K. tunicata varied directly with the ambient salinity during the 10-30-10 o/oo S cycle. The average heart rate of M. edulis was significantly lower during cyclic changes in salinity than at the respective control salinities; a similAr relationship existed for K. tunicata during the 10-30-10 o/oo S cycle. Heart rate of M. edulis varied in a parallel manner with oxygen consumption during both cycles. K. tunicata heart rate was relatively constant and could not be fitted to a regression line during the 10-30-10 o/oo S cycle. The normalized heart rate increased to 113% of control at 10 o/oo S of the 30-10-30 o/oo S cycle and returned to the control rate by 12 h. (Deal-EIS)
W80-02983

DISTRIBUTION OF COBALT 60 IN A MOLLUSC, A CRUSTACEAN AND A FRESHWATER TELEOST: VARIATIONS AS A FUNCTION OF THE SOURCE OF POLLUTION AND DURING ELIMINATION,
CEA Centre d'Etudes Nucleaires de de Cadarache, Saint-Paul-les Durance (France). Dept. de Protection.
J. C. Amiard, and C. Amiard-Triquet.
Environmental Pollution, Vol 13, p 199-213, 1979. 4 Fig, 4 Tab, 25 Ref.

Descriptors: *Cobalt radioisotopes, *Path of pollutants, *Absorption, Animal physiology, Fish physiology, Animal metabolism, Mollusks, Snails, Crustaceans, Crayfish, Carp, Radiochemical analysis, *Bioaccumulation, *Tissue analysis.

Radioisotopes of cobalt (57,58,60Co) are present in nuclear test debris as well as in effluents of the non-military nuclear industry. The stable isotope, which is a constituent of vitamin B12, has very important biological functions. For each species, three experiments were carried out: (1) starved animals were immersed in 60Co-contaminated water; (2) animals were immersed in contaminated water and received radioactive food and (3) animals were placed in fresh water without any pollutant but received contaminated food. Radiation doses were calculated for contamination via both food and water. When 60Co is taken up directly from water, the most contaminated organs are external ones, especially the shell of the snail Lymnaea palustris and the exoskeleton and feeding appendages of the crayfish Astacus leptodactylus. Contamination via food is responsible for a relatively greater accumulation of radiocobalt in internal organs. The cobalt content of muscles-that is to say the edible parts of crayfish and common carp is very low. The highest concentrations recorded are in the visceral mass of the snail, the digestive gland of the crayfish and the kidneys of the carp. Internal doses for these organs are considerably higher than those for entire animals. Therefore, as a result of 60Co distribution, they are critical organs for the freshwater species. Except for the carp, external radiation is very weak compared with internal radiation. (Deal-EIS)
W80-02984

OXYGEN CONSUMPTION AND THE RESPIRATORY RESPONSES TO DECLINING OXYGEN TENSION IN THE CRAB EBALIA TUBEROSA (PENNANT) (CRUSTACEA: DECAPODA: LEUCOSIIDAE),
Marine Biological Station, Millport (Scotland).
P. J. Schembri.
Journal of Experimental Marine Biology and Ecology, Vol 41, p 133-142, 1979. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Crabs, *Oxygen requirements, *Animal behavior, Dissolved oxygen, Water chemistry, Size, Weight, Animal metabolism, Respiration, Animal physiology, Crustaceans.

Oxygen consumption and its relationship to body weight and activity have been examined in Ebalia tuberosa (Pennant). Ebalia showed only very limited ability to regulate their oxygen consumption under conditions of declining P02. Respiratory independence was markedly affected by the level of activity of the animals. When inactive, respiratory independence was maintained down to a critical P02 of only about 130 mm Hg while when active, the crabs behaved as perfect conformers. Inactive Ebalia responded to a decrease in P02 by increasing the pumping activity of the scaphognathites and heart. This increased activity continued even at oxygen tensions lower than the Pc. The rate of reversals of the ventilatory currents did not change with decreasing P02. In the active crabs, the pumping activity of the scaphognathites and heart, and the rate of current reversals were higher than in the inactive animals, and a decrease in P02 did not bring about any further change in any of these responses. When exposed to hypoxic conditions for long periods initially inactive crabs survived longer than did active animals. (Deal-EIS)
W80-02986

MECHANISMS OF DDT RESISTANCE IN LARVAE OF THE MOSQUITO AEDES AEGYPTI L.,
Victoria Univ. of Manchester (England). Dept. of Zoology.
A. E. McDonald, and R. J. Wood.
Pesticide Science, Vol 10, p 375-382, 1979. 5 Tab, 24 Ref.

Descriptors: *DDT, *Mosquitoes, *Pesticide toxicity, *Resistance, Biodegradation, DDE, Pesticide kinetics, Genetics, Adaptation, Animal metabolism, Larval growth stage, Insects, Insecticides, Chlorinated hydrocarbon pesticides, Mortality, *Chlorfenethol, *Sesamex.

Larvae of eight strains of Aedes aegypti were exposed to DDT and compared for resistance, DDT uptake, in-vivo breakdown of DDT and residual unmetabolised DDT. Resistance varied widely between strains, three being fully susceptible, two almost immune and three of intermediate resistance. Breakdown of DDT by dehydrochlorination to 1,1-dichloro-2,2-bis(4-chlorophenyl)ethylene(pp'-DDE) occurred in all strains and was greater in the five resistant types, but there was no significant correlation between the extent of breakdown in the resistant strains and the level of resistance. Moreover the overall difference between susceptible and resistant strains disappeared when they were compared at a low, almost sublethal, concentration of DDT. Larvae of resistant strains carried a greater absolute quantity of unmetabolised DDT in the body and were able to tolerate levels of DDT that were lethal to susceptible larvae. However the two most resistant strains contained significantly less DDT plus pp'-DDE than strains of intermediate resistance from which they had been derived. It is concluded that three factors contribute to larval DDT resistance in A. aegypti; (1) increased metabolism to pp'-DDE; (2) increased tolerance to unmetabolised internal DDT; and (3) reduced content of DDT+pp'-DDE (only in the most resistant strains and due either to reduced absorption or increased excretion). These factors are discussed in relation to known larval resistance genes. (Deal-EIS)
W80-02987

THE GILL SIALIC ACID CONTENT AS AN INDEX OF ENVIRONMENTAL STRESS IN RAINBOW TROUT, SALMO GAIRDNERI, RICHARDSON,
Genova Univ. (Italy). Inst. of Zoology.
A. Arillo, C. Margiocco, and F. Melodia.
Journal of Fish Biology, Vol 15, p 405-410, 1979. 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Bioindicators, *Rainbow trout, *Ammonia, Hydrogen ion concentraton, Water chemistry, Water quality, Fish physiology, Monitoring, Analytical techniques, Biochemistry, Acids, *Tissue analysis, *Gills.

The gill sialic acid content in rainbow trout exposed to several aqueous concentrations of ammonia and/or to a high environmental pH was determined by two different methods. The results showed Warren's method was adequate for the biological material, even without purification of the extracts by Dowex 2x8 resin. A significant increase of the sialic acid concentration occurred in fish exposed to ammonia.
W80-02988

PHYTOPLANKTON RESPONSE TO LOW LEVEL NUTRIENT ENRICHMENT THROUGH UPWELLING IN THE COLUMBIAN CARIBBEAN BASIN),
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
J. E. Corredor.
Deep-Sea Research, Vol 26A, p731-741, 1979. 6 Fig, 2 Tab, 26 Ref.

Descriptors: *Phytoplankton, *Growth rates, *Nutrients, *Upwelling, Water circulation, Nitrates, Biomass, Productivity, Water chemistry, Ecosystems, Stratification, *Carribean Sea.

Inorganic nutrient enrichment through upwelling in the eastern Colombian Caribbean Basin stimulates phytoplankton growth. Growth rates, however, are significantly lower than those observed in the upwelling ecosystems in the major eastern boundary currents because of the relatively impoverished nature of the source waters for the Guajira upwelling: the Subtropical Underwater. Initial organic growth factor limitation appears to cause uncoupling of nitrate uptake and phytoplankton biomass increase. Nitrate levels in recently upwelled waters are rapidly reduced to concentrations close to half-saturation constants previously reported for marine phytoplankton. (Deals-EIS)
W80-02989

EFFECTS OF TEMPERATURE AND FOOD ON DEVELOPMENTAL TIMES AND GROWTH IN DAPHNIA OBTUSA KURZ AND SIMOCEPHALUS VETULUS (O. F. MULLER) (CRUSTACEA, CLADOCERA),
Istituto Italiano di Idrobiologia, Pallanza.
R. DeBernardi, P. Lacqua, and E. Soldavini.
Memorie dell'Istituto Italiano di Idrobiologia, Vol 36, p 171-191, 1978. 5 Fig, 6 Tab, 38 Ref.

Descriptors: *Water temperature, *Growth rates, *Feeding rates, Daphina, Crustaceans, Zooplankton, Growth stages, Productivity, Regression analysis, Statistical analysis, Adaptation, Fertility, Fecundity, *Simocephalus.

A set of experiments has been constructed in order to investigate the influence of temperature and food availability on the developmental rates and growth of the two cladocerans Daphnia obtusa and Simocephalus vetulus. Four temperatures (20, 15,10,5C) and six food levels (60, 20, 5, 2, 1, 0.5 cal/1) have been tested. No direct relationships were found between the food level and time of egg development. However, the food availability affected the number and size of eggs in the brood pouch. A significant regression between temperature in degrees centigrade and post-embryonic development time in hours was found for both species. The data was discussed as it pertained to strategies of food resources utilization. (Deal-EIS)
W80-02990

THE OCCURRENCE AND SEASONAL VARIATIONS OF NA, K, CA, MG AND HEAVY METALS IN TAIWAN'S OYSTERS AND CLAMS,
Taiwan Provincial Coll. of Marine Science and Technology, Keelung.
S.-Y. Hsu, G.-S. Wang, and S.-S. Jeng.
Bulletin of the Institute of Zoology, Academia Sinica, Vol 18, No 1, p 11-20, 1979. 4 Fig, 8 Tab, 8 Ref.

Descriptors: *Heavy metals, *Oysters, *Clams, *Seasonal, Cadmium, Copper, Iron, Mercury,

Nickel, Zinc, Sodium, Potassium, Calcium, Magnesium, Commercial shellfish, Spectrophotometry, Chemical analysis, *Tissue analysis, *Taiwan.

For the purpose of finding out the chemical properties of oysters and clams cultured in Taiwan, the contents of the major elements, Na, K, Ca, Mg and heavy metals, Cd, Cu, Fe, Hg, Ni, Pb and Zn in these shellfishes were investigated. Shucked oysters and marketed clams were collcted from 7 stations along the west coast of Taiwan from April 1976 to February 1977. The mean concentraions of Na, K, Ca and Mg were found to be 233, 187, 34.3 and 35.3 mg/100 g, respectively. The one that had the most interesting seasonal variation among these major elements was Na in oysters. It was found that the seasonal changes of Na and glycogen in oysters were almost identical. The heavy metal concentration in Taiwan's oysters and clams could be divided into two groups. The group which had higher concentrations consisted of Zn, Fe and Cu, the mean concentraions in oysters being 120.4, 86.1 and 20.4 ppm, and in clams being 14.9 136.1 and 5.7 ppm. The other group which had lower concentrations consisted of Pb, Ni, Cd and Hg, the mean concentrations in oysters being 1.29, 0.55, 0.11 and 0.01 ppm, and in clams being 1.53, 1.09, 0.09 and 0.02 ppm, respectively. These contents of heavy metals were not higher than the 'normal' levels and should not constitute a hazard for consumers. (Deal-EIS)
W80-02991

CHEMICAL COMPOSITION OF TAIWAN'S OYSTERS AND CLAMS,
Kaohsiung Inst. of Marine Technology (Taiwan).
S-S. Jeng, S-Y. Hsu, and G-S. Wang.
Bulletin of the Institute of Zoology, Academia Sinica, Vol 18, No 1, p 1-10, 1979. 3 Fig, 8 Tab, 16 Ref.

Descriptors: *Oysters, *Clams, *Chemical analysis, Estuaries, Commercial shellfish, Proteins, Lipids, Seasonal, Annual, Foods, Chemical properties, *Tissue analysis, *Taiwan.

Chemical composition of Taiwan's oysters crassostrea gigas and clams Meretrix lusoria were investigated to learn the relation between chemical composition and growing conditions, and food quality of the shellfishes. Shucked oysters and marketed clams were collected bi-monthly from 7 major culture areas along the west coast of Taiwan from April 1976 to February 1977. Moisture, protein, lipid, glycogen and ash contents were analyzed. It was found that the market size of taiwan's osyter meat was quite small, 1.18-1.73 g, and the market size of clams with shells was 9.0-27.5 g with an average of 16.5 g,. The sizes of thse two shellfishes were all larger in april-September than in October-February. One of the characteristics of chemical composition of Taiwan's oysters was that, compared with oysters of other countries, the protein concentration was higher, while the glycogen concentraton was lower. The glycogen content of oysters reached its maximum in June-July, and became the lowest in the end of December. The general composition of clams was similar to that of oyster. The reason why oysters and clams were larger and had higher glycogen and ash contents in summer may be due to the fact that there is much river water flowing into the coastal area during that period. (Deal-EIS)
W80-02992

5B. Sources Of Pollution

POLLUTION ASSESSMENT AND POTENTIAL MOBILITY OF HEAVY METALS IN GREAT LAKES SEDIMENTS,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
R. M. Owen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133580, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, East Lansing, Project Completion Report, October, 1979. 25 p. OWRT A-101-MICH(1), 14-34-0001-9024.

Descriptors: *Heavy metals, Mobility, Iron, Manganese, Chromium, Copper, Zing, *Sediments, Little Traverse Bay, Lake Michigan.

A sequential extraction scheme is utilized to determine the geochemical fractionation of Fe, Mn, Cr, Cu, and Zn in different grain size classes for sediment samples collected from within and around Little Traverse Bay, Lake Michigan. The partitioning of Fe, Cr, and Cu in both sediment and presently-eroding coastal bluff samples are similar. Also, the concentrations of these metals in fine grained particles are not proportional to the increased surface area of these grains compared with larger grain sizes. Both of these results indicate that these metals have undergone little authigenic change since entering the lacustrine environment. However, sediment Zn concentrations are significantly higher than in coastal bluff samples, and also have a different geochemical fractionation. This result is attributed to the precipitation of Zn in authigenic phases. In general, Mn shows relatively little mobility in the bay's oxidizing environment, except in areas where Mn nodules are forming.
W80-02704

POINT AND NON-POINT POLLUTION INFLUENCING WATER QUALITY IN A RURAL HOUSING COMMUNITY,
Oregon State Univ., Corvallis. Water Resources Research Inst.
R. J. Seidler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133911, Price codes: A05 in paper copy, A01 in microfiche. Report WRRI-64, November 1979. 76 p, 12 Fig, 13 Tab, 27 Ref. OWRT A-045-ORE(1).

Descriptors: *Non-point pollution, *Drinking water, *Rural areas, Bacterial detection, *Potable water, Coliforms, Oak Creek watershed(OR).

The purpose was to analyze the intensity and origin of non-point pollution in protected and unprotected regions of a rural watershed (Oak Creek watershed). The Oak Creek watershed covers an area of 750 ha. The upper (northern) part of the basin drains part of McDonald Forest, a 4450 ha State-owned forest which is undisturbed except for research activities. The lower (southern) part of the basin includes a rural community consisting of 78 homes. Numbers and species of fecal indicator bacteria were studied through the entire watershed. Also, the presence of the intestinal pathogen Salmonella was studied, since the relationship of numbers of indicators and presence of this pathogen do not strictly correlate. Storm events, particularly important in assessing the impact of non-point pollution, were defined in a quantitative fashion at stations along Oak Creek. Finally, the impact of non-point pollution on ground waters serving as drinking water supplies in this modern rural development was studied.
W80-02708

MICROBIOLOGICAL STUDY OF STORM RUNOFF WATERS FROM A 100% RESIDENTIAL AREA IN CANADA,
Canada Centre for Inland Waters, Burlington (Ontario).
B. J. Dutka.
Canadian Research, Vol 10, No 6, p 32, 51-53, November-December 1977. 4 Fig, 3 Tab, 10 Ref.

Descriptors: *Water pollution sources, *Urban runoff, *Canada, *Microorganisms, Storm runoff, Water quality, Cities, Water sampling, On-site investigations, Coliforms, Testing procedures, Streptococcus, Salmonella, Viruses, On-site data collections, Distribution patterns, Residential areas.

Very little data exists on the microbiological composition of Canadian storm water runoffs. This study was undertaken to fill this gap by the collection of baseline data and to study the incidence of pathogens (salmonella, viruses and P. aeruginosa) in storm runoff waters. Routine microbiological samples for coliforms, fecal coliforms, fecal streptococci, P. aeruginosa, fungi, heterotrophs, salmonella/100 ml and Leptospira/100 ml were hand collected at a weir outfall. Total coliform, fecal coliform, fecal streptococcus, Pseudomonas aeruginosa, and fungus density estimates were performed on all samples. It was concluded that: (1) There is no predictable pattern for maximum bacterial population occurrence in storm runoff waters. (2) Pathogens were isolated during all phases of the 240 min studies. Thus, no predictable pattern of pathogen appearance could be established. (3) The unpredictable distribution pattern of peak microbial populations and pathogen incidence would force one to downplay the concept of collecting and treating a specific portion of each storm to decrease the potential health hazards in recipient waters. (4) Infiltration samples continue to be a source of low grade continuous pollution. (5) Studies should be carried out to establish the degree of microbiological loading on the creek and inshore (Lake Ontario) receiving waters, the extent of this loading into the main lake body and the duration of each event's effect (bacterial die-off rate). (Humphreys-ISWS)
W80-02728

SPECTRAL MEASUREMENTS OF OCEAN-DUMPED WASTES TESTED IN THE MARINE UPWELLED SPECTRAL SIGNATURE LABORATORY,
National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center.
W. G. Witte, J. W. Usry, C. H. Whitlock, and E. A. Gurganus.
Available from the National Technical Information Service, Springfield, VA 22161 as N79-31890, Price codes: A03 in paper copy, A01 in microfiche. NASA Technical Paper 1480, September 1979. 32 p, 8 Fig, 4 Tab, 13 Ref, 1 Append.

Descriptors: *Upwelling, *Spectrometers, *Remote sensing, *Waste disposal, *Reflectance, Atlantic Ocean, Laboratory tests, Sewage sludge, Water pollution, Chemical precipitation, Monitoring, Sea water.

Upwelled spectral radiance and reflectance were measured for dilutions of industrial wastes from three sources as part of a study to evaluate the feasibility of remotely monitoring ocean waste dumping. The wastes used for the test came from the American Cyanamid plant in New Jersey, the Dupont (Graselli) plant in New Jersey, and a consortium of pharmaceutical plants in Puerto Rico. Types of wastes include rubber wastes, paper wastes, waste treatment chemicals, organophosphates, insecticides, intermediates, surfactants, dimethylhydroxylamine and anisole production wastes, penicillin and antibiotics production wastes, and organic solvents. Waste samples were mixed with various concentration of artificial seawater. Equipment used included a Xenon arc lamp, a reflecting mirror, a spectrometer, and a 99% diffuse reflector. All of the waste samples formed precipitates when added to the sea water. Overall the samples from the DuPont plant and the Puerto Rican plants did not give upwelled signals significantly different from base water samples. Waste samples from the American Cyanamid plant showed increased reflectance with increasing concentrations for all wavelengths. Also, reflectance decreased as wavelength increased. The tests showed that increased turbidity does not always cause increased inherent reflectance. (Seigler-IPA)
W80-02740

SOME WATERSHED ANALYSIS TOOLS FOR LAKE MANAGEMENT,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
R. K. Rodiek.
In: Lake Restoration, Report No EPA 440/5-79-001, p 85-94, 1979. 4 Fig, 8 Tab, 34 Ref.

Descriptors: *Michigan, *Eutrophication, *Model studies, *Phosphorus, Lakes, Lake stages, Runoff, Watersheds(Basins), Septic tanks, Waste disposal, Water pollution sources, Soil types, Dissolved oxygen, Chlorophyll, Lake shores.

As an alternative to extensive sampling programs, planners and engineers can use a predictive phosphorus budget model to determine the most effi-

cient lake restoration techniques for a eutrophied lake. Model results can be used to choose techniques for restricting phosphorus input or for removing or inactivating phosphorus already in the lake. Lobdell Lake in Michigan is used as an example for model application. Following increased development the lake is experiencing classical eutrophication symptoms such as blue-green algal blooms, oxygen depletion, and an abundance of littoral macrophytes. Local health officials indicate that ineffective and overloaded septic systems are a major factor in the problem. Morphologic and hydrologic data needed for the model include lake drainage area, surface area, lake volume, precipitation, lake evaporation, mean depth, and long-term areal runoff. The model allows for the estimation of all necessary parameters without extensive field research. Phosphorus inputs can be estimated by using average literature values for overland runoff, bulk precipitation, and septic seepage. If results indicate that a reduction of phosphorus loading from septic seepage is needed, alternative collection and treatment facilities would be required. A mapping technique for the identification of soils in the watershed is presented. (See also W80-02773) (Seigler-IPA)
W80-02790

PHOSPHORUS TRANSPORT ACROSS THE SEDIMENT-WATER INTERFACE,
Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
D. E. Armstrong.
In: Lake Restoration, Report No EPA 440/5-79-001, p 169-175, 1979. 1 Fig, 6 Tab, 43 Ref.

Descriptors: *Lake sediments, *Bottom sediments, *Sediment-water interfaces, *Phosphorus, Eutrophication, Aquatic algae, Algal control, Thermal stratification, Organic compounds, Oxidation, Reduction(Chemical), Interfaces, Water pollution, Nutrients.

The transport of dissolved inorganic phosphate (dissolved reactive phosphate) from lake bottom sediments is an important factor in the success of in-lake restoration programs. The physical, chemical, and biological characteristics of a lake system control the rate of phosphate transport. Results from algae incubated with sediments suspended in a phosphorus-free medium show a high degree of correlation between decrease in sediment inorganic phosphorus and increases in algal organic phosphorus. Approximately 50% of the sediment inorganic phosphorus was available to algae probably due to the tendency for an equilibrium in phosphorus concentrations. Nonapatite inorganic phosphorus is mainly associated with the iron in sediments which results in a strong dependence of phophate transport from sediments on the oxidation-reduction status of the sediments. Investigations show high concentrations of dissolved reactive phosphate in the interstitial waters of surface sediments. When compared to phosphate concentrations in the overlying lake water, this shows the potential for a high flux from the bottom sediments. Measurements of phosphorus transport rates show that they increase as temperature increases. It appears that phosphorus internal loading tends to be high for moderate-depth lakes that develop thermal stratification and anoxic conditions in bottom waters. (See also W80-02773) (Seigler-IPA)
W80-02799

SEDIMENT-RELATED FLUVIAL TRANSMISSION OF CONTAMINANTS: SOME ADVANCES BY 1979,
Saskatchewan Dept. of the Environment, Regina. Inland Waters Directorate.
R. J. Allan.
Available from Inland Waters Directorate, Environment Canada, Ottawa, Ontario, Canada K1A 0E7. Scientific Series No 107, 1979. 24 p, 16 Fig, 9 Tab, 51 Ref.

Descriptors: *Wastes, *Fluvial sediments, *Sediment transport, Drainage systems, Sampling, Analysis, Nutrients, Heavy metals, Separation techniques, Rivers, Streams, Great Lakes.

Suspended sediment can be a major transport mechanism for nutrients and contaminants in drainage systems. Bottom sediment pollution has been extensively studied, but until recently suspended sediment has seldom been chemically analysed. Sufficient suspended sediment could not be collected for detailed nutrient and contaminant analysis until the advent of land-based continuous flow centrifuges. This report describes the evolution of this area of investigation and the stage of development reached in Canada as of 1979. Problems of sampling and analytical requirements are discussed. Examples are included of the types of results being obtained by the main Canadian investigators. Relationships between suspended and bottom sediment chemistry are described. Interaction between those involved in sediment surveys for engineering purposes, water quality monitoring, and research into drainage system contaminant transmission is advocated. Such interaction could rapidly extend existing knowledge in this area, critical to pollution control and environmental basin management. (WATDOC)
W80-02843

WATER MOVEMENT IN A LAND TREATMENT SYSTEM OF WASTEWATER BY OVERLAND FLOW,
Army Terrestrial Sciences Center, Hanover, NH. Applied Research Branch.
For primary bibliographic entry see Field 2G.
W80-02853

BIOLOGICAL EVALUATION OF NON-POINT SOURCE POLLUTANTS IN NORTH CAROLINA STREAMS AND RIVERS,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5C.
W80-02871

THE MERRIMACK: DESIGNS FOR A CLEAN RIVER. ANNEX C: CONSULTANT'S INDUSTRIAL WASTEWATER PROFILES.
Weston (Roy F.) Inc., Boston, MA.
For primary bibliographic entry see Field 5E.
W80-02876

EFFECT OF BOTTOM CONDITIONS ON EUTROPHY OF IMPOUNDMENTS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2H.
W80-02881

A METHOD FOR MODELING THE DEPOSITION OF SULFUR BY PRECIPITATION OVER REGIONAL SCALES,
Argonne National Lab., IL. Atmospheric Physics Section.
B. B. Hicks, and J. D. Shannon.
Journal of Applied Meteorology, Vol 18, No 11, p 1415-1420, November 1979. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Air pollution, *Rainfall, *Sulfur, *Model studies, Mathematical models, Precipitation(Atmospheric), Pollutants, Path of pollutants, Acids, Cloud physics, Meteorology, Sulfur deposition, Scavenging, Acid precipitation.

Radioactive fallout data suggest that the concentration of pollutants in rainfall, while highly variable, might be described on the average by about an inverse half-power dependence on the amount of precipitation. Recent measurements of sulfur concentrations in summer rainfall collected at Argonne National Laboratory tend to support this contention, as do preliminary results derived from operations of the DOE precipitation chemistry network. The concept was extended to develop a bulk removal rate for airborne total sulfur by precipitation for use in regional dispersion modeling. (Sims-ISWS)
W80-02886

REGIONAL PATTERNS OF CONTAMINANTS (PAH, PESTICIDES AND TRACE METALS) IN SNOW OF NORTHEAST BAVARIA AND THEIR RELATIONSHIP TO HUMAN INFLUENCE AND OROGRAPHIC EFFECTS,
Bayreuth Univ. (Germany, F.R.). Lehrsteuhl fuer Hydrologie.
E. Schrimpff, W. Thomas, and R. Herrmann.
Water, Air, and Soil Pollution, Vol 11, No 4, p 481-497, May 1979. 14 Fig, 4 Tab, 22 Ref.

Descriptors: *Snow, *Pollutants, *Pesticides, *Distribution patterns, Metals, Organic compounds, Wastes, Zinc, Lead, Cadmium, Copper, Aldrin, Dieldrin, Spatial distribution, Regional analysis, Foreign countries, Analysis, Analytical techniques, Pyridine pesticides, Orography, On-site investigations, Foreign research, Areal, *Bavaria, Snow pollution, Carcinogen, Polycyclic aromatic hydrocarbons.

In January 1978, 31 snow samples were collected throughout NE-Bavaria and were analyzed for trace metals (Zn, Pb, Cd, Cu), pesticides (alpha-BHC, Lindane, Aldrin, Dieldrin) and polycyclic aromatic hydrocarbons (PAH) (3,4-benzopyrene, 1,12-benzoperylene, fluoranthene and 3,4-(o-phenylene)-pyrene). The regional pattern of PAH-concentrations can be explained as follows: above urban areas and through orographic uplifting of the air, PAH's are scavenged from the atmosphere by snow. The trace metals and specific conductance show similar regional patterns, although the pattern for Pb is influenced by automobile traffic as well as by glass and ceramic industries. The pesticides show less distinct patterns relative to the other two groups of contaminants. Using multivariate statistics, it was shown that the trace metals with the exception of Pb and the PAH's had regional patterns similar to each other but distinct from the pesticides. Although orography, urbanization, and industries are shown to affect the regional patterns of PAH's and the trace metals, this is not the case for pesticides. They originate from diffuse sources in agricultural and forested lands. (Humphreys-ISWS)
W80-02896

CONCENTRATIONS OF BENZO(A)PYRENE IN THE SEDIMENTS OF SIX WESTERN UNITED STATES LAKES,
Department of Energy, New York. Environmental Measurements Lab.
M. Heit.
Water, Air, and Soil Pollution, Vol 11, No 4, p 447-454, May 1979. 2 Tab, 27 Ref.

Descriptors: *Lakes, *Sediments, *Water pollution sources, *Organic compounds, *Caliornia, *Utah, On-site investigations, Cores, Analysis, Analytical techniques, Data collections, Chromatography, *Los Angeles(CA), *Utah Lake, Carcinogens, Benzo(a)pyrene.

Sections of sediment cores from 6 western United States lakes were analyzed for benzo(a)pyrene, B(a)P, by thin layer chromatography, fluorescence, and gas chromatography-mass spectrometry. The highest concentration, 305 micrograms/kg dry weight, was found in a Los Angeles reservoir. The concentrations of benzo(a)pyrene in the sediment from all the lakes were found to be lower than expected when compared to other values reported in the literature. However, there appears to be some association between the concentration of B(a)P in the sediment and the environment in which the sample was taken. The highest concentrations occurred in the samples from urban Los Angeles, followed by Utah Lake which appears to be affected by a steel mill. Benzo(a)pyrene was probably not detected in the sediment of lakes several miles downwind from two coal fired power stations either because the sampling locations were too far from the stations, or because dilution of the B(a)P by large amounts of sediment entering the lakes from relatively pristine areas occurred. (Humphreys-ISWS)
W80-02898

DEPOSITION OF TRACE METALS IN STREAM SEDIMENTS,
Montana State Univ., Bozeman. Dept. of Chemistry.
G. K. Pagenkopf, and D. Cameron.
Water, Air, and Soil Pollution, Vol 11, No 4, p 429-435, May 1979. 1 Fig, 4 Tab, 20 Ref.

Descriptors: *Water pollution sources, *Metals, *Streams, *Sediments, *Montana, Lead, Cadmium, Copper, Iron, Water pollution, On-site investigations, Natural streams, Analysis, Water quality, Data collections, Industrial wastes, Lead smelter.

Sediment samples were collected downstream from a Pb smelter and analyzed for Cd, Cu, Fe, Pb, and Zn. The concentrations of these trace metals decrease with increased distance from the smelter. The decrease in trace metal content was utilized to provide an indication of how rapidly artificially high levels of trace metals are reduced to the carrying capacity of a natural water. Equilibrium calculations were utilized to predict the water's intrinsic trace metal carrying capacity. The analytical values observed for Prickley Pear Creek, Montana, and rivers of the United States were listed. Agreement between the calculated values and those observed in Prickley Pear Creek is reasonably good. The concentrations of Cd and Pb in United States rivers are considerably less than those calculated and observed in this study area. (Humphreys-ISWS)
W80-02899

PHOSPHORUS INPUTS INTO A STREAM DRAINING AN AGRICULTURAL WATERSHED, II: AMOUNTS CONTRIBUTED AND RELATIVE SIGNIFICANCE OF RUNOFF TYPES,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
A. N. Sharpley, and J. K. Syers.
Water, Air, and Soil Pollution, Vol 11, No 4, p 417-428, May 1979. 5 Tab, 31 Ref.

Descriptors: *Agricultural watersheds, *Water pollution sources, *Phosphorous, *Runoff, Streams, Bank erosion, Streamflow, Subsurface runoff, On-site investigations, Sediments, Water quality, Pastures, Data collections, Surface runoff, Water pollution, Foreign research, *New Zealand.

The amounts of P-forms transported in surface, accelerated subsurface, and subsurface runoff, and the stream draining a 20 ha area of a pasture watershed were measured for 3 years. Stream-bank erosion and resuspension of stream sediment contributed the major proportion of the particulate P(PP), total P, and sediment transported annually in stream flow (86, 77, and 74%, respectively). In addition, 29% of the annual dissolved inorganic P(DIP) loading of the stream in 1977 was attributed to the release of P from suspended in situ particulate material. Remarkably similar proportions of water, P forms, and sediment were contributed by the runoff types in each of the 3 years of study. Subsurface runoff contributed the major proportion (67%) of stream flow. Although surface runoff contributed only a minor proportion of stream flow (11%), it contributed the major proportion of both DIP (32%) and PP loading (9%) compared with the other runoff types. Differences in the amounts of P forms transported in the three runoff types can be attributed to several factors, one of the most important being the time of contact between soluble P in runoff waters and soil components. The results obtained in this study suggested that in the watershed under study, the amounts of water discharged and P-forms and sediment transported in surface runoff from the plots were reasonably representative of those from the subwatershed. (Humphreys-ISWS)
W80-02900

SEPTIC TANK WASTEWATER DISPOSAL SYSTEMS AS PHOSPHORUS SOURCES FOR SURFACE WATERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. A. Jones, and G. F. Lee.
Journal of the Water Pollution Control Federation, Vol 51, No 11, p 2764-2775, November 1979. 3 Fig, 6 Tab, 15 Ref.

Descriptors: *Septic tanks, *Effluents, *Phosphorus, *Nutrients, Groundwater, Surface waters, Lakes, Water pollution, Pollutants, Path of pollutants, Sampling, On-site investigations, Monitoring, Wells, Water quality, Hydrology, Groundwater movement, Waste water, Waste water disposal.

A 4-year groundwater monitoring study was conducted in the immediate vicinity of an active septic tank system in northwestern Wisconsin to determine the potential for septic tank effluent to contribute to the excessive fertilization of area surface waters. During the course of this study, movement of septic tank effluent in the groundwater was indicated by measured values of several conservative parameters. However, there was no evidence of the transport of the phosphate from septic tank effluent through the groundwater even at the monitoring point closest to the tile field (about 15 m down groundwater gradient from the tile field). The results of this study confirmed the conclusions drawn from similar studies in other areas reported in the literature, namely, that phosphorus from septic tank wastewater disposal system effluent is usually not readily transported through the groundwater. (Sims-ISWS)
W80-02904

LEACHING OF POLLUTANTS FROM SANITARY LANDFILL MODELS,
Technion-Israel Inst. of Tech., Haifa.
A. Raveh, and Y. Avnimelech.
Journal of the Water Pollution Control Federation, Vol 51, No 11, p 2705-2716, November 1979. 1 Fig, 12 Tab, 16 Ref.

Descriptors: *Leaching, *Landfills, *Laboratory tests, Solid wastes, Leachates, Compaction, Water pollution, Water pollution sources, Groundwater, Temperature, Heavy metals, Nitrogen, Ammonia, Organic matter, Wastes, Pollutants, Path of pollutants, Composting, Sanitary landfills.

The effects of compaction, shredding, composting, and temperature during filling periods on leaching of pollutants from sanitary landfills were studied in columns. The main pollutants detected were organic carbon, volatile organic acids, organic and ammonia nitrogen, and heavy metals. A good correlation was found between the decrease, with time, of the concentration of pollutant and an exponential equation $c = ab$ to the t power, where c is the concentration, t is the time, while a and b are constants. The decay is fast for nonshredded and loosely packed refuse, probably because of a relatively fast and efficient process of humification. The time span needed for the stabilization of the landfill was calculated to be 3 to 15 years, depending on the different treatments. (Sims-ISWS)
W80-02905

ANOMALIES IN CATION CONCENTRATIONS DURING PERCOLATION OF SIMULATED EFFLUENT THROUGH SAND,
California Inst. of Tech., Pasadena.
J. Uradnisheck, and W. H. Corcoran.
Journal of the Water Pollution Control Federation, Vol 51, No 11, p 2691-2704, November 1979. 16 Fig, 2 Tab, 14 Ref.

Descriptors: *Soil water, *Percolation, *Soils, *Ions, *Laboratory tests, Calcium, Magnesium, Nitrification, Nitrates, Ion exchange, Cations, Sands, Soil water movement, Effluents, Waste water, Bacteria, Solutes, Oxygen, Carbon dioxide.

Periodic increases in concentrations of calcium and magnesium ions during percolation of secondary effluent in spreading basins at Whittier Narrows, California, have caused concern. During the drying period of the spreading cycle, aqueous hydrogen ions are produced by nitrification of adsorbed ammonium ions. Subsequently, calcium, magnesium, sodium, and potassium ions are ion-exchanged by the aqueous hydrogen ions in the soil's interstitial structure. The thin film of solution surrounding the mineral grains then develops a large concentration of dissolved nitrate salts of the alkaline earths. During spreading, the leading edge of solution acquires a temporarily high concentration of alkaline-earth salts by mixing and ion exchange. (Sims-ISWS)
W80-02906

SIMPLIFIED DIURNAL CURVE ANALYSIS,
Hickok (Eugene A.) and Associates, Inc., Wayzata, MN.
J. B. Erdmann.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE6, Proceedings Paper 15026, p 1063-1074, December 1979. 4 Fig, 2 Tab, 11 Ref, 2 Append.

Descriptors: *Dissolved oxygen, *Algae, *Oxygenation, *Rivers, Analytical techniques, Photosynthesis, Water quality, Respiration, Oxygen, Diurnal, Correlation analysis, Water pollution, Water pollution effects, *Charles River(MA).

Simplified equations have been developed for analysis of river diurnal curves, or graphs of dissolved oxygen (DO) concentration versus time covering day-long periods, to produce estimates of gross photosynthesis and respiration rates. Reaches with long time of flow between stations can be analyzed because rate of DO change is calculated by Stokes' total time derivative. Application to the Charles River, Massachusetts, demonstrated usefulness of the calculated rates in water quality analysis. The simplified equations produced photosynthesis and respiration rates in good agreement with previously reported rates derived by computerized 'systematic' analysis. Calculated photosynthesis rates correlated with the product of algae times phosphorus concentrations. In the Charles River, photosynthesis dominated over atmospheric reaeration as a source of DO replenishment in late June. (Sims-ISWS)
W80-02913

SEDIMENTS, WATER AND FOOD CHAINS AS SOURCES OF CHLORINATED HYDROCARBONS FOR BENTHIC ORGANISMS IN THE MEDITERRANEAN SEA,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
G. G. Polikarpov, S. W. Elder, G. Fowler, P. Benayoun, and P. Parsi.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaceo, 24-27 Novembre 1978, Antalaya, Turkey, p 281-284, 1979. 7 Ref.

Descriptors: *Polychlorinated biphenyls, *Path of pollutants, *Benthic fauna, Organic compounds, Absorption, Worms, Mussels, Shrimp, Water chemistry, Bottom sediments, Chemical properties, Animal metabolism, *Polychaetes, *Depuration, *Bioaccumulation, *Tissue analysis.

The sediment dwelling polychaete worm, Nereis deversicolor, is able to accumulate polychlorinated biphenyls (PCB) from both sediments and sea water. Despite a significantly higher concentration factor for PCBs from water (800) than from sediment (3.5), it is concluded that sediments are the major source of PCBs for worms under the existing concentrations of PCBs in Mediterranean water and sediments. Depuration of PCBs from worms living in an uncontaminated environment follows an exponential function. Experiments with Mytilus galloprovincialis showed that PCBs accumulatedover a period of 97 days are readily lost when the mussels are transferred to clean sea water. The loss of PCBs from the soft tissues of these molluscs amounted to 50% after one day, 91.3% after one month and 99.6% after three months. The benthic shrimp, Lysmata seticaudata, rapidly accumulated PCBs from both food and water. The experimental results clearly indicate that PCBs from both food and water. The experimental results clearly indicate that PCBs in the marine environment are readily cycled through the benthic biota. (Deal-EIS)
W80-02937

LEVELS OF CHLORINATED HYDROCARBONS IN MARINE ANIMALS FROM THE CENTRAL MEDITERRANEAN,
Catania Univ. (Italy). Ist. di Chimica e Chimica Industriale.
V. Amico, G. Impellizeri, G. Oriente, M. Piattelli, and S. Sciuto.
Marine Pollution Bulletin, Vol 10, p 282-284, 1979. 1 Fig, 1 Tab, 4 Ref.

Descriptors: *Pesticide Residues, *DDT, *Polychlorinated biphenyls, *Marine animals, DDE, DDD, Aldrin, Dieldrin, Chlorinated hydrocarbon pesticides, Mussels, Shrimp, Mullets, water Quality standards, Public health, Chemical analysis, *BHC, *Tuna, *Anchovy, *HCB, *Tissue analysis, *Bioaccumulation.

Concentrations of chlorinated hydrocarbons (DDT and metabolites, PCBs, aldrin, dieldrin, HCB and BHCs) have been determined in the tissues of five species of marine animals sampled in selected areas of the central Mediterranean. The species examined were anchovy, striped mullet, tuna, shrimp and mussel. The major contaminants were DDT and metabolites and the industrial PCBs. The concentrations of these compounds were about two order of magnitude below accepted public health standards. (Deal-EIS)
W80-02939

CONTAMINATION OF THE MEDITERRANEAN BLUE AND WHITE DOLPHIN BY ORGANOCHLORINE COMPOUNDS (IN FRENCH),
Institut Scientifique et Technique des Peches Maritimes, Nantes (France).
For primary bibliographic entry see Field 5A.
W80-02940

A SUMMARY OF THE EFFECTS OF URBAN WASTES (MARSEILLE-CORTIOU) ON THE ZOOPLANKTONIC POPULATION OF THE NERITIC ZONE (IN FRENCH).
Groupe Equipe Pollution Pelagique de Marseille (E.P.O.P.E.M.) Aix-Marseille-2 Univ. (France). Lab. d'Hydrobiologie.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 377-379, 1979. 2 Ref, (English summary).

Descriptors: *Water pollution effects, *Zooplankton, Path of pollutants, *Domestic wastes, Dominant organisms, Sewage effluents, Sewage, Neritic, Mediterranean Sea, Marseille, Environmental effects, Animal populations, Marseille.

Quantitative and qualitative variations of zooplankton have been studied in a neritic area under the influence of Marseille-Cortiou sewage outfall. This area can be divided in four zones: (1) a very polluted one, close to the outfall (500 m) with low populations, (2) a very polluted one (2 km wide) but with a five times higher population density than the first zone, (3) an intermediate one which is a mixing zone, (4) a non polluted zone where restructuring of the zooplanktonic populations happens. (Katz-EIS)
W80-02942

EFFECTS OF THE DEFOLIANT 2-4-5-T ON THE DINOFLAGELLATE PROROCENTRUM MICANS IN CULTURE (IN FRENCH),
Arago Lab., Banyuls-sur-Mer (France).
For primary bibliographic entry see Field 5A.
W80-02945

ACCUMULATION OF MANGANESE IN DONAX TRUNCULUS L. (BIVALVIA),
Modena Univ. (Italy). Inst. of Zoology.
E. Orlando, and M. Mauri.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 297-299, 1979. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Manganese, *Path of pollutants, *Clams, Water pollution sources, Bivalves, Chemical wastes, Industrial wastes, Chemical analysis, Spectrophotometry, Metals, *Bioaccumulation, *Tissue analysis, *Donax, *Tuscan coast, Clambrone(Tuscany), Feniglia(Tuscany).

The levels of manganese in Donax collected in two localities of Tuscany, polluted at different degrees, have been determined. Manganese is present for the most part in kidneys. Particulate manganese rather than soluble metal seems to have a higher importance so far as the accumulation of manganese in Donax is concerned. Manganese contents in clams from Calambrone was as high as 16 ppm. (Deal-EIS)
W80-02949

THE ROLE OF ZOOPLANKTON FECAL PELLETS IN TRANSPORTING PCBS FROM THE UPPER MIXED LAYER TO THE BENTHOS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
S. W. Fowler, L. F. Small, D. L. Elder, Y. Unlu, and J. LaRosa.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 289-291, 1979. 8 Ref.

Descriptors: *Zooplankton, *Polychlorinated biphenyls, *Path of pollutants, Copepods, Pesticide kinetics, Benthos, Vertical migration, Organic compounds, chemical analysis, Water chemistry, Suspended solids, Fecal pellets, *Mediterranean Sea.

Field and laboratory studies are under way to assess zooplankton fecal pellet production as a mechanism for the vertical transport of surface-introduced polychlorinated biphenyls. Natural fecal pellets produced by freshly collected copepods were found to have PCB concentrations of 1300 ppb dry weight. Particle collectors moored at 100 m depths were used to trap particulates which contained a large percentage of fecal matter. This material has also been analyzed for PCBs and found to contain relatively high levels, ranging rate from 200 to 710 ppb dry weight. Mass flux estimates for PCBs and sinking rate measurements of copepod fecal pellets support the contention that zooplankton fecal pellets play a major role in the downward vertical transport and biogeochemical cycling of PCBs in the Mediterranean Sea. (Deal-EIS)
W80-02950

ARSENIC FLUX THROUGH MUSSELS AND SHRIMP,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
M. Y. Unlu, and S. W. Fowler.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 285-287, 1979. 6 Ref.

Descriptors: *Path of pollutants, *Shrimp, *Mussels, *Arsenic radioisotopes, Radiochemical analysis, Tracers, Absorption, Water chemistry, Salinity, Size, Water temperature, Animal metabolism, *Arsenic, *Bioaccumulation, *Tissue analysis.

Arsenic-74 was used to study various aspects of bioaccumulation and loss of arsenic in Mediterranean mussels (Mytilus galloprovincialis) and benthic shrimp (Lysmata seticaudata). Over a concentration range from 2 to 100 microgr As/l uptake increased as the arsenic concentration in water increased, however, the response was not proportional. Arsenic uptake was inversely related to salinity in both species. Animal size and temperature also affected the arsenic accumulation pattern to some degree. In the case of mussels most of the arsenic accumulated was located in the soft parts. The fraction of total arsenic accumulated in shrimp exoskeleton and muscle was roughly the same (N30-50%). (Deal-EIS)
W80-02951

BIOACCUMULATION FROM WATER AND ELIMINATION OF VANADIUM IN SELECTED MARINE INVERTEBRATES,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W80-02952

BIOTRANSFORMATION OF BENZO(A)PYRENE BY LITTLE SKATE HEPATIC MICROSOMES-STIMULATION AND RECONSTITUTION OF BENZO(A)PYRENE HYDROXYLASE ACTIVITY,
Middle East Technical Univ., Ankara (Turkey). Dept. of Life Sciences.
E. Arinc, R. J. Pohl, J. R. Bend, and R. M. Philpot.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 273-276, 1979. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Enzymes, *Pesticide toxicity, *Fish physiology, Biochemistry, Animal metabolism, Pesticide residues, Organic compounds, Biodegradation, Chemical analysis, 2, 4, 5-T, *TCDD, *3MC, *Biotransformation, *Tissue analysis.

Upon pretreatment of skates with 3-methylcholanthrene (3MC) and TCDD, skate hepatic benzo(a)pyrene hydroxylase activity increased about 8 to 18 fold, respectively. The hepatic microsomal benzo(a)pyrene hydroxylase activity of skates was solubilized and separated into its component parts. Cytochrome P-450, NADPH-cytochrome c reductase, and lipid fractions were required in order to reconstitute microsomal benzo(a)pyrene hydroxylase activity. (Deal-EIS)
W80-02953

COMPARISON BETWEEN THE HG BODY BURDEN OF THYNNUS THYNNUS FROM THE MEDITERRANEAN AND THE ATLANTIC,
Siena Univ. (Italy). Lab. di Idrobiologio.
For primary bibliographic entry see Field 5A.
W80-02954

PCBS AND CHLORINATED PESTICIDES IN ORGANISMS FROM THE LIGURIAN SEA,
Genoa Univ. (Italy). Ist. di Chimica Generale.
V. Contardi, R. Capelli, T. Pellacani, and G. Zanicchi.
Marine Pollution Bulletin, Vol 10, p 307-311, 1979. 1 Fig, 7 Tab, 17 Ref.

Descriptors: *Pesticide residues, *Marine animals, DDT, Polychlorinated biphenyls, DDE, Aroclors, DDD, Chemical analysis, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Gas chromatography, Mussels, Biodegradation, Mullets, Shrimp, *BHC, *Tissue analysis, *Bioaccumulation, *Mediterranean Sea, *Anchovy.

The concentrations of BHCs, DDTs and PCBs have been determined in samples of Engraulis encrasicholus, Mytilus galloprovincialis, Nephrops norvegicus, Mullus barbatus, Euthymnus alletteratus and Sarda sarda, collected in different stations of the Ligurian Sea. Increasing levels of contamination were found in the order: Nephrops, Mytilus and Engraulis, Mullus and Euthymnus, Sarda. A comparison with the data available in the literature relevant to Mytilus samples collected in Genoa in 1973-74 showed a notable decrease in the concentration of chlorinated residues. (Deal-EIS)
W80-02955

RELATIONSHIP OF CADMIUM-INDUCED HYPOCALCEMIA WITH MORTALITY IN RAINBOW TROUT (SALMO GAIRDNERI) AND THE INFLUENCE OF TEMPERATURE ON TOXICITY,
Concordia Univ., Montreal (Quebec). Dept. of Biological Sciences.
M. Roch, and E. J. Maly.
Journal of the Fisheries Research Board of Canada, Vol 36, No 11, p 1297-1303, 1979. 3 Fig, 1 Tab, 30 Ref.

Descriptors: *Rainbow trout, *Toxicity, *Cadmium, *Water temperature, Calcium, Fish physiology, Animal metabolism, Mortality, Heavy metals, Mode of action, Magnesium, Growth stages, *Tissue analysis, *Blood chemistry, Acclimation.

Cold-acclimated (6C) rainbow trout, exposed to lethal concentrations of cadmium, survived longer

than warm-acclimated (12 and 18C) trout. Ten-day lethal thresholds indicated that cold-acclimated trout could also resist greater concentrations of cadmium. Calcium concentrations in the plasma of fish, exposed to 0.3 mg Cd/l, declined steadily during the period of exposure when subjected to five thermal regimes, different combinations of acclimation and experimental temperatures. The rate of decline in calcium concentrations was correlated with the rate of mortality. Survival times of 12C-acclimated trout subsequently exposed to cadmium at 6, 12, and 18C were inversely dependent on temperature, whereas survival times of trout acclimated to 6, 12, and 18C and subsequently exposed to cadmium at acclimation temperatures do not show the same temperature dependence. Survival times of 12 and 18C-acclimated and exposed fish were similar, indicating that temperature compensation may promote longer resistance of 18C-acclimated and exposed fish than when they are acclimated to 12C and abruptly transferred and exposed to cadmium at 18C. Symptoms of cadmium poisoning of the fish are consistent with the effects of extreme hypocalcemia and are similar to those reported in the literature for various fish. The decline of calcium concentrations in the plasma may be the direct cause of mortality. (Deal-EIS)
W80-02956

FLUORIDE IN ANTARCTIC KRILL (EUPHAUSIA SUPERBA) AND ATLANTIC KRILL (MEGANYCTIPHANES NORVEGICA),
Havforskningsinstitutt, Bergen (Norway). Inst. of Vitamin Research.
For primary bibliographic entry see Field 5A.
W80-02957

TEMPERATURE INFLUENCE ON BASAL ACTIVITY AND INDUCTION OF MIXED FUNCTION OXYGENASE ACTIVITY IN FUNDULUS HETEROCLITUS,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-02958

ESTIMATING RATE CONSTANTS FOR THE UPTAKE AND CLEARANCE OF CHEMICALS BY FISH,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
W. B. Neely.
Environmental Science and Technology, Vol 13, p 1506-1510, 1979. 2 Fig, 4 Tab, 16 Ref.

Descriptors: *Mathematical models, *Fish physiology, *Chemical properties, Analytical techniques, Estimating, Path of pollutants, Absorption, Animal metabolism, Perches, Rainbow trout, Brook trout, Brown trout, Lake trout, Organic compounds, Model studies, D1-2-ethylhexylphthalate, DEHP, Chlorpyrifos, 2, 3, 7, 8, Tetrachlorodibenzo-p-dioxin(TCDD).

With the increased need for predicting the movement and distribution of chemicals in an aquatic environment, knowledge of the rate constants governing the uptake and clearance of chemicals in fish is required. In the absence of experimental data, a method is proposed for making reasonable estimations of these two rate constants based on the physiology of the fish and the properties of the chemical. The credibility of the proposal is demonstrated by comparing predicted rate constants with values measured in the laboratory. (Deal-EIS)
W80-02959

EXAMINATION OF PHOSPHORUS CYCLING AND CONTROL OF PHYTOPLANKTON DYNAMICS IN LAKE ONTARIO WITH AN ECOLOGICAL MODEL,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5A.
W80-02962

FLUXES OF DISSOLVED AND PARTICULATE CALCIUM IN SELECTED TISSUES OF CRASSOSTREA VIRGINICA,
Delaware Univ., Lewis. Marine Studies Complex.
L. V. Sick, C. C. Johnson, and C. A. Siegfried.
Marine Biology, Vol 54, p 293-299, 1979. 2 Fig, 4 Tab, 21 Ref.

Descriptors: *Oysters, *Calcium, *Animal metabolism, Absorption, Animal behavior, Metabolism, Nutrient requirements, Tracers, Phytoplankton, Chemical properties, Shellfish, Animal physiology, Water chemistry, *Tissue analysis, *Bioaccumulation.

Rates of calcium incorporation by selected tissues of Crassostrea virginica increased in a step-wise fashion from lowest values among organisms exposed to ambient total calcium concentrations of 45 mg/l, intermediate values among oysters exposed to 135, 225, and 315 mg/l, to highest rates for oysters exposed to 360 mg/l. Although excised visceral mass tissue had highest rates of calcium incorporation relative to mantle, muscle, and both organic and inorganic portions of the shell, mantle tissue appeared to have the most dynamic response to changes in ambient calcium concentrations. Rates of dissolved calcium incorporation from ambient water were approximately two to three orders of magnitude higher than comparable rates from ingested algal food. Behavioral response to concentrations of selected ionic species in the ambient environment may have been responsible for observed differences in rates of calcium incorporation. (Deal-EIS)
W80-02966

EFFECTS OF OIL TRANSFERRED FROM INCUBATING GULLS TO THEIR EGGS,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
K. A. King, and C. A. Lefever.
Marine Pollution Bulletin, Vol 10, p 319-321, 1979. 1 Tab, 14 Ref.

Descriptors: *Oil, *Path of pollutants, *Bird eggs, *Gulls, Oil pollution, Nests, Hatching, Mortality, Embryonic growth stage, Incubation, Reproduction, Texas, Animal behavior.

No. 2 fuel oil, or water, was applied to the breast feathers of incubating laughing gulls trapped at their nest site on an island colony in Texas. Gulls were released after treatment and allowed to incubate their eggs for 5 days. Oil was transferred from the feathers of incubating adults to their eggs and resulted in 41% embryo mortality compared with 2% in controls. (Deal-EIS)
W80-02967

TRACE METALS IN FUCOID ALGAE AND PURPLE SEA URCHINS NEAR A HIGH ARCTIC LEAD/ZINC ORE DEPOSIT,
British Columbia Research Council, Vancouver.
A. Bohn.
Marine Pollution Bulletin, Vol 10, p 325-327, 1979. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Trace elements, *Algae, *Baseline studies, Mining, Lead, Zinc, Metals, Iron, Metabolism, Copper, Absorption, Trophic level, Food webs, Canada, Cadmium, Physiology, *Arsenic, *Sea urchins, *Tissue analysis, *Bioaccumulation.

Seaweed and urchins accumulate Fe and Zn to higher concentrations near a lead/zinc ore body than further away. The concentration of three metals (Cu, Fe and Zn) in seaweed increase with age of tissue. As and Cd are lowest in tissue of intermediate age, suggesting a reversible bonding mechanism for the two elements. Concentrations of Fe in whole urchins, and Zn in the gonads, are higher than concentrations in Fucus tips, which represent a lower level in the food web. Fe is higher in whole sea urchins than in their gonads. For As and Zn the relationship is reversed. (Deal-EIS)
W80-02969

DDTS IN MARINE FISHES FOLLOWING TERMINATION OF DOMINANT CALIFORNIA INPUT: 1970-77,
California Univ., Los Angeles. Dept. of Environmental Science and Engineering.
P. E. Smokler, D. R. Young, and K. L. Gard.
Marine Pollution Bulletin, Vol 10, p 331-334, 1979. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *DDT, *Pesticide residues, *Marine fish, Perches, Bass, Pesticide kinetics, Persistence, Chlorinated hydrocarbon pesticides, Sewage effluents, Bottom sediments, DDD, DDE, Outlets, Fish physiology, Food habits, *Sole, *Tissue analysis, *Bioaccumulation.

Through source control, total DDT annual emissions from the Los Angeles County Sanitation Districts' submarine outfalls decreased by a factor of 30 between 1971 and 1977. Here we report persistent elevated levels of DDT residues measured in three species of marine fishes with distinctly different feeding habits. Over the study interval, median levels of DDT residues have decreased 3-fold (8-fold and 4-fold from peak medians) in flesh of black perch and kelp bass. However, there was no apparent decrease in Dover sole. The sediment reservoir is the likely source of persistent contamination of fishes in the discharge area. (Deal-EIS)
W80-02971

MERCURY CONTENT OF SHARK FROM SOUTH-WESTERN AUSTRALIAN WATERS,
Western Australia Dept. of Fisheries and Fauna, Perth. Marine Research Labs.
For primary bibliographic entry see Field 5A.
W80-02972

MAJOR DETOXIFICATION PATHWAYS FOR PENTACHLOROPHENOL IN GOLDFISH,
Kyushu Univ., Fukuoka (Japan). Lab. of Fisheries and Chemistry.
For primary bibliographic entry see Field 5A.
W80-02973

A CULTURE STUDY OF SALINITY RESPONSES IN ECOTYPES OF TWO ESTUARINE RED ALGAE,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.
For primary bibliographic entry see Field 5A.
W80-02974

EFFECTS OF ARSENIC SPECIATION AND PHOSPHATE CONCENTRATION ON ARSENIC INHIBITION OF SKELETONEMA COSTATUM (BACILLARIOPHYCEAE),
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5A.
W80-02975

RECYCLING OF METABOLIZED IRON BY THE MARINE DINOFLAGELLATE AMPHIDINIUM CARTERAE,
Oregon State Univ., Corvallis. School of Oceanography.
B. E. Frey, and L. F. Small.
Journal of Phycology, Vol 15, p 405-409, 1979. 3 Fig, 20 Ref.

Descriptors: *Dinoflagellates, *Metabolism, *Iron, Phytoplankton, Growth rates, Hydrogen ion concentration, Cytological studies, Nutrient requirements, Recycling, Herbivores, Trophic level, Cycles, Seasonal, Bioassay, *Amphidinium.

Senescent, iron-limited cultures of Amphidinium carterae Hulburt were used to detect the presence of iron made available for phytoplankton growth by recycling of metabolized iron from disrupted cells. Both physical disruption of cells and physical disruption plus exposure to a low pH were tested. The test cultures remained viable over long periods of time, and were stimulated to full growth by the addition of Fe, but not by the addition of any other nutrients. Simple physical disruption of cells caused only a very slow release of available Fe, while disruption of cells plus exposure to a low pH

resulted in a rapid release of available Fe. It is suggested that the digestive processes of herbivores are instrumental in the rapid regeneration of Fe as a nutrient available for phytoplankton growth. (Deal-EIS)
W80-02976

DISTRIBUTION OF ESSENTIAL AND TOXIC METALS IN THE TERRESTRIAL GASTROPOD ARION ATER,
University Coll. of Wales, Aberystwyth. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02981

ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS IN BIRD EGGS FROM THE FALKLAND ISLANDS AND NORTH GERMANY, (IN GERMAN),
Hamburg Univ. (Germany, F. R.). Zoologisches Inst.
H. Hoerschelmann, K. Polzhafer, K. Figge, and K. Ballschmiter.
Environmental Polluton, Vol 13, p 247-269, 1979. 4 Fig, 7 Tab, 20 Ref. (English abstracts).

Descriptors: *Pesticide residues, *Bird eggs, *Path of pollutants, Chlorinated hydrocarbon pesticides, Polychlorinated biphenyls, DDT, DDD, DDE, Endrin, Aldrin, Dieldrin, Pesticide kinetics, Waterbirds, Duck, Gulls, *Heptachlor, *HCB, Methoxychlor, *Tissue analysis, Falkland Islands, North Sea, North Germany.

The content of organochlorine pesticides and polychlorinated biphenyls of 46 eggs of sea, coastal and some inland birds and 47 eggs of comparable north German species was determined quantitatively. The concentration of organochlorine pesticides and polychlorinated biphenyls in eggs from the Falkland Islands was found to be an order of magnitude lower than those in the eggs of comparable north German species. It is suggested that the levels of pesticides found in eggs from these isolated islands reflect the general global contamination level. In contrast with Europe, where the situation is very complex, the consequences of individual changes in local industry and society can be clearly followed in the contamination levels of the eggs. (Deal-EIS)
W80-02982

DISTRIBUTION OF COBALT 60 IN A MOLLUSC, A CRUSTACEAN AND A FRESHWATER TELEOST: VARIATIONS AS A FUNCTION OF THE SOURCE OF POLLUTION AND DURING ELIMINATION,
CEA Centre d'Etudes Nucleaires de de Cadarache, Saint-Paul-les Durance (France). Dept. de Protection.
For primary bibliographic entry see Field 5A.
W80-02984

MECHANISM OF DDT RESISTANCE IN LARVAE OF THE MOSQUITO AEDES AEGYPTI L.; THE EFFECT OF DDT SELECTION,
Victoria Univ. of Manchester (England). Dept. of Zoology.
A. E. McDonald, and R. J. Wood.
Pesticide Science, Vol 10, p 383-388, 1979. 4 Fig, 2 Tab, 2 Ref.

Descriptors: *Mosquitoes, *DDT, *Pesticide toxicity, *Resistance, *Aquatic insects, Genetics, Adaptation, Animal metabolism, Biodegradation, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Insecticides, Insects, DDE, Larval growth stage, Pesticide residues, Absorption.

Selection with pp'-DDT was applied to fourth-stage larvae of Aedes aegypti along four lines, starting with larvae of the F2 generation from crosses between a susceptible strain and each of four resistant strains. Larval resistance increased substantially along each line but there was little or no change in the percentage breakdown of DDT to pp'-DDE in vivo and in no line were these two variables significantly correlated. Percentage breakdown was generally higher at 10 mg than at 50 mg/litre. DDT uptake (defined as content of DDT+pp'-DDE) was generally higher after exposure to 50 mg than to 10 mg/litre. The amount of internal residual (unmetabolised) DDT tolerated by larvae of the TExNS line also increased significantly with resistance. The levels in the other lines followed the pattern of uptake, remaining steady in T8xNS despite the increase in survival, rising at first and then declining in the two Bangkok lines. Thus selection produced a higher tolerance to internal unmetabolised DDT in the two Trinidad lines but led ultimately to a lower content of DDT+pp'-DDE in the two Bangkok lines. The reasons for this behaviour are discussed. (Deal-EIS)
W80-02985

OXYGEN CONSUMPTION AND THE RESPIRATORY RESPONSES TO DECLINING OXYGEN TENSION IN THE CRAB EBALIA TUBEROSA (PENNANT) (CRUSTACEA: DECAPODA: LEUCOSIIDAE),
Marine Biological Station, Millport (Scotland).
For primary bibliographic entry see Field 5A.
W80-02986

MECHANISMS OF DDT RESISTANCE IN LARVAE OF THE MOSQUITO AEDES AEGYPTI L.,
Victoria Univ. of Manchester (England). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02987

THE OCCURRENCE AND SEASONAL VARIATIONS OF NA, K, CA, MG AND HEAVY METALS IN TAIWAN'S OYSTERS AND CLAMS,
Taiwan Provincial Coll. of Marine Science and Technology, Keelung
For primary bibliographic entry see Field 5A.
W80-02991

THE CARBON BALANCE IN AN EXPERIMENT REGARDING THE BACTERIAL BIODEGRADATION OF A TOPPED CRUDE OIL (IN FRENCH),
Laboratoire de Cryptogamie du MNHN, Paris (France).
J. Oudut.
Environmental Pollution, Vol 13, p 177-187, 1979. 3 Fig, 7 Tab, 24 Ref, (English Abst).

Descriptors: *Microbial degradation, *Oil, *Soil bacteria, Biodegradation, Chemical reactions, Chemical analysis, Gas chromatography, Aromatic compounds, Organic compounds, Biomass, Carbon dioxide, *Crude oil.

The relative percentage of the different forms of hydrocarbons in an in vitro crude oil biodegradation experiment was determined. Oil was cultured with soil bacteria at 25C for 21 days. The abiotic loss (evaporation) was estimated to be 20% of the initial carbon and the global biodegradation, comprising total and primary biodegradation, reached 21%. The total biodegradation included the carbon transformation into CO2 (mineralisation) and into biomass, estimated respectively at 13.7 and 5.6% of the initial carbon. The primary biodegradation, as measured by the organic carbon dissolved in the medium, represented 1.5% of the initial carbon. Another estimation of the global biodegradation, independently obtained by the residual weight of the chloroform extract, gave a similar result (22%). An analysis of the chloroform-extracted residue, performed by column fractionation and gas-liquid chromatography, showed that the saturate fraction was 40% degraded and the aromatic fraction, 18%. The pristane and phytane were completely biodegraded and no increase of long chain paraffins was noted. A statistically highly significant absolute increase of the asphaltic fraction, due to accumulation of extracellular products, was shown. (Deal-EIS)
W80-02993

A THREE-DIMENSIONAL MODEL FOR ESTUARIES AND COASTAL SEAS: VOLUME VI, BRISTOL BAY SIMULATIONS,
RAND Corp., Santa Monica, CA.
S. Liu, and J. J. Leendertse.
Rand Publications Series Report No-R-2405-NOAA, September 1979. 127 p, 98 Fig, 1 Tab, 13 Ref, 6 Append. 03-022-35249.

Descriptors: *Computer models, *Continental shelf, *Tidal waters, *Oil spills, Wind tides, Simulation analysis, Bays, Currents(Water), Ocean currents, Drifting(Aquatic), Movement, Water circulation, Diurnal, Isotherms, Mapping.

Tide and wind effects in St. George Basin and Bristol Bay in the Bering Sea were simulated by use of a three-dimensional model. The model will serve as a basis for predicting oil spill trajectories and risk analysis for proposed oil lease sites in the area. Surface drift by which oil spills are dispersed is difficult to predict in the area due to strong tide dominance and consistent vertical nonhomogeneity in the current and density fields. Because of these complicated wind and tidal forces a three-dimensional model rather than a two-dimensional model was developed. Procedures for model setup, adjustments, and a verification run are presented. Field data were used to determine bottom stress coefficients and constants for the turbulence-closure computation. Extensive graphical representations were possible because many plotting programs were already available in two-dimensional systems. Predicted tides at the open boundaries were used to drive the model for the verification run. To evaluate the model computed current distributions were compared to observed values with good agreement. Overall the model is a good basis for predicting bay response to wind, tide, and local density variations. (Seigler-IPA)
W80-02999

5C. Effects Of Pollution

APPLICATION OF LINEAR POLARIZATION TECHNIQUES TO THE STUDY OF CARBON STEEL CORROSION IN DILUTE AMMONIUM NITRATE SOLUTIONS AND IRRIGATION GROUNDWATERS,
Nebraska Water Resources Center, Lincoln.
D. L. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133903, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report, September 1, 1979. 20 p, 9 Fig, 5 Tab, 6 Ref. OWRT A-046-NEB(1).

Descriptors: *Corrosion, *Irrigation, *Distribution systems, *Ammonium compounds, *Nitrates, Water pollution effects, Polarity, Nebraska, Anions, Mathematical models, Steel, Potentiometers, Nitrogen compounds, Herbicides, Insecticides, Groundwater.

Linear polarization measurements were used to predict corrosion rates for low carbon 1018 steel, a material commonly used in irrigation structures and electrical components. Corrosivity was determined as a function of ammonium nitrate which is commonly distributed to fields through irrigation systems. Both dilute ammonium nitrate solutions and corrosive groundwater field samples from wells in central Nebraska were tested. No ammonium nitrate was added to the field samples. Dual potentiostat systems, a PAR system with a Corning test cell for anodic polarization and an Aardvark system with a modified test cell for linear polarization were used. Corrosion rate data were based on 1018 steel weight change as a function of time and ammonium nitrate concentration. Results show a good correlation between potentiodynamic anodic polarization, linear polarization, and weight change data. Also, corrosion rates for carbon steel (and copper) increase substantially as ammonium nitrate concentration increases. The linear polarization technique was found to be a useful method for testing material suitability for use in irrigation systems. Polarization graphs are presented for the various samples and conditions tested. (Seigler-IPA)
W80-02709

PHYSIOLOGICAL AND BEHAVIORAL CHANGES IN WILD WATERFOWL EXPOSED TO CONCENTRATED SALT WATER,
Colorado State Univ., Fort Collins. Dept. of Physiology and Biophysics.
R. A. Herin, D. H. Will, and E. A. Fountain.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 390, Price codes: A06 in paper copy, A01 in microfiche. Final Project Report prepared for the Bureau of Reclamation, June 27, 1979. 109 p, 31 Fig, 10 Tab, 96 Ref, 2 Append. 7-07-83-V0704.

Descriptors: *Mallard duck, *Waterfowl, *Salt tolerance, *Saline water, Birds, Dehydration, Animal behavior, Animal physiology, Animal metabolism, Osmosis, Colorado, Colorado River, Water birds, Water pollution effects, Ponds.

Male Mallard ducks (Anasplatyrhynchous) were used in nine experiments to study the effects of exposure to saltwater on waterfowl. A concern for the waterfowl visiting the large diversion saltwater evaporation pools in Paradox Valley, Colorado, prompted the study. Both laboratory and field experiment data on physiological and behavorial effects were correlated to develop methods for counteracting the harmful changes in the birds. Test objects were: (1) to determine the basis and sites of body fluid loss; (2) to determine the basis for decreased body temperature in exposed ducks; and (3) to provide a better definition of exposed wild waterfowl behavioral responses. Results show that severe dehydration occurred after 36 hours in salt water (270,000 ppm) with no food or freshwater. Water was primarily lost through the feet and legs. Increased environmental temperature resulted in greater dehydration. For the first 12 hours of exposure body temperature and metabolism were near normal, however, after that temperature decreased and metabolism increased. Duck behavior was relatively constant with a initial period of high excitability and activity followed by a time of unresponsiveness then finally coma and death. The cause of death is probably respiratory or cardiac failure due to a severe electrolyte imbalance in the blood and hypothermia. The ducks recovered when removed in time from the salt water and provided with a warm dry environment and fresh drinking water. (Seigler - IPA)
W80-02737

THE MODIFICATION OF INLAND WATERS,
J. Cairns, Jr.
In: Wildlife and America Council on Environmental Quality, Washington, D.C. p 146-162, 1978. 3 Fig, 4 Tab, 57 Ref.

Descriptors: *Inland waterways, *Protection, *Preservation, *Environmental effects, Water pollution, Wetlands, Marshes, Thermal pollution, Irrigation, Forest management, Toxins, Dams, Channeling, Ecosystems, Storm runoff, Radioactivity.

The ecological and environmental effects of inland waters modification is discussed. A brief history of modification is provided to illustrate the initial lack of concern for environmental effects. While there is now great concern for the presentation of the quality of inland waters, most citizens still do not fully appreciate or understand the complexity of ecosystems because urbanization has separated them from natural systems. Threats to the integrity of inland waters include point sources, nonpoint sources, toxicants, heated waste water, suspended solids, organic materials, velocity changes, dams, channelization, storm sewers, irrigation, clearcutting and other forestry practices, tainting substances, radioactivity, transport of hazardous cargo, pumped storage reservoirs, and interbasin transfers. Another area of concern is the destruction of valuable wetlands that store flood waters, filter and assimilate dissolved nutrients, stabilize shorelines, and provide a habitat for fish and wildlife. Passage of the Federal Water Pollution Control Act Amendments of 1972 provided some protection for wetlands. More protection for inland waters could be provided by developing inland water quality assurance programs, performing risk analysis for water ecosystems, continuing biological monitoring and promoting water conservation. A system for rewarding good ecological behavior and penalizing bad ecological behavior would also afford some protection. (Seigler - IPA)
W80-02746

ESTIMATING THE HAZARD OF CHEMICAL SUBSTANCES TO AQUATIC LIFE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. Cairns, K. L. Dickson, and A. W. Maki.
Hydrobiologia, Vol 64, No 2, p 151-166, 1979. 2 Fig, 3 Tab, 6 Ref.

Descriptors: *Hazards, *Pesticide residues, *Aquatic life, *Testing procedures, Analytical techniques, Water pollution, Path of pollutants, Water pollution sources, Reproduction, Larvae, Environmental effects, Microenvironment, Mortality, Biological properties, Chemical wastes.

Following the Toxic Substances Control Act (TSCA) the need for hazard assessment procedures such as those devised by the American Society for Testing and Materials (ASTM), the American Institute of Biological Sciences (AIBS), and Monsanto became apparent. A hazard assessment procedure, a sequential series of tests should allow a chemical to be used, banned, or require more extensive testing. The ASTM, AIBS, and Monsanto procedures are designed to evaluate hazards to aquatic life in order to facilitate the registration of pesticides. The ASTM and Monsanto procedures evaluate a broad spectrum of use for any potential aquatic hazard while the AIBS procedure is more pesticide specific. The three procedures are compared on several points including program design, baseline data, decision criteria, options, uncertainty, and environmental levels. Other toxicity tests such as acute lethality, embryo-larval, reproductive, residue accumulation, and several others are ranked by significance. A discussion of the safety factor concept is included. Basically this is a numerical quantity multiplied by the known biological effect concentration. It is concluded that the basic framework for estimating chemical aquatic life hazards has been established. This framework now needs to be applied, refined, and made as cost effective as possible. (Seigler-IPA)
W80-02747

THERMAL DISCHARGE RESEARCH,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
J. Cairns, D. S. Cherry, and S. R. Larrick.
Water Spectrum, Vol 11, No 4, p 1-8, Fall 1979. 11 Fig.

Descriptors: *Powerplants, *Thermal powerplants, *Bioassay, *Aquatic animals, *Thermal pollution, Virginia, Clams, Aquatic environment, Water temperature, Chlorination, Entrainment, Fish behavior, Migration, Coals, Plankton nets.

The Glen Lyn site-specific field laboratory in Virginia and adjacent artificial stream system were used to study the role of powerplant discharges upon the aquatic ecosystem in order to comply with Federal regulations. The assessment included studies of heated waste water, intermittent antifouling chlorination, coal ash effluents, and aquatic organism entrainment or impingement. A fish hatchery trough with a series of 12 250-watt infrared lamps of increasing intensity were used to test temperature preference. After one to three hours of observing fish movements in the trough a preferred temperature could be determined. Temperature and chlorine avoidance were studied in two linear troughs that were filled from opposite ends with river water. Temperature or chlorine levels in one end were raised while the other end remained normal. Levels were raised until a definite avoidance was recorded. A conventional static test and a circulating tank test were used for coal ash bioassays. Sampling baskets and nets were used to study impingement and entrainment effects. Artificial streams were found to be valuable testing tools because they: (1) use natural river water, (2) provide improved simulation of natural or waste water effects, (3) use indigenous flora or fauna, (4) reduce lapse time for holding test fish, and (5) provide a semi-controlled field laboratory arrangement. By using these site-specific techniques that plant was able to show that its operation caused no appreciable harm to the fish populations in the river. (Seigler-IPA)
W80-02748

THE AVAILABILITY OF SEDIMENT PHOSPHATE TO ALGAE,
Hydrological Research Inst., Pretoria (South Africa); and Department of Water Affairs, Pretoria (South Africa).
D. C. Grobler, and E. Davies.
Water S. A., Vol 5, No 3, p 114-122, July 1979. 3 Fig, 7 Tab, 22 Ref.

Descriptors: *Aquatic algae, *Eutrophication, *Phosphates, *Nitrilotriacetic acid, *Bottom sediments, Nutrients, Bioassay, Chemical analysis, Nitrogen, Dams, Water sampling, Reservoirs, Biomass, Separation techniques.

The relationship between the amount of phosphate extracted from sediment by chemical means, and the growth rate of Selenastrum capricornutum in the sediment was examined. Fifteen bottom sediment samples were collected at the Bloemhof Dam with a Birge-Ekman grab. Phosphate availability to algae was tested by using the sediment as the only source of phosphate in nutrient media. Bioassays were done in triplicate and algal biomass was estimated using a version of the Walkley-Black method. Chemical analyses were conducted for cation exchange capacity, total phosphate, inorganic phospha te, organic phosphate, dilute-hydrochloric acid-dilute fluoride extractable phosphate, Kjeldahl nitrogen, and organic carbon. Results show that part of the bottom sediment phosphorous was available for algal growth. Also, algal phosphate consumption showed significant correlation with the amount of phosphate extracted by chemical means (the nitrilotriacetic acid procedure) and with the inorganic phosphate content of the sediment. A non-linear relationship exists between algal available phosphate and inorganic phosphate, while the chemically extracted phosphate and algal available phosphate relationship is linear. Overall sediment-bound phosphate was found to be readily available for algal growth. This could lead to algal growth problems in reservoir areas. The estimation of biologically available phosphate by chemical methods is promising. (Seigler-IPA)
W80-02751

THE USE OF THE WALKLEY-BLACK METHOD FOR ORGANIC CARBON DETERMINATION AS A PROCEDURE FOR ESTIMATING ALGAL YIELDS,
Hydrological Research Inst., Pretoria (South Africa); and Department of Water Affairs, Pretoria (South Africa).
D. C. Grobler, and E. Davies.
Water S. A., Vol 5, No 3, p 138-143, July 1979. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Aquatic algae, *Biomass, *Bottom sediments, *Carbon, Eutrophication, Nutrients, Aquatic productivity, Primary productivity, Suspended solids, Sediments, Volumetric analysis, Spectrophotometry, Walkley-Black method.

The Walkley-Black method for determining organic carbon in soils was modified and proved to be a successful tool for determining algal biomass in sediment containing waters. The original method estimates organic carbon concentrations by a determination of the amount of dichromate consumed by organic carbon by back titration of excess dichromate with a ferrous solution. The modification use a colorimetric procedure to measure green chromium-III-ion production as a direct measure of organic carbon. Algal biomass determination from the Walker-Black method are compared with biomass determinations from the suspended solids concentration method. Algal culture of Selenastrum capricornutum and microcystis aeruginosa were used for the determinations. Tests were performed in both sediment containing and nonsediment containing cultures. Both methods for determining algal yields had good precision with low coefficients of variation. Also, a good linear

relationship was observed between organic carbon determinations and suspended solids. Advantages of the Walkley-Black method are: (1) it can be used to estimate biomass in sediment containing cultures, (2) it requires less expensive instrumentation, and (3) reqired operator training levels are much lower. (Seigler-IPA)
W80-02753

GENERAL CONCEPTS OF LAKE DEGRADATION AND LAKE RESTORATION,
Maine Univ. at Orono.
P. D. Uttormark.
In: Lake Restoration, Report No EPC 440/5-79-001, p 65-69, 1979. 3 Tab, 6 Ref.

Descriptors: *Eutrophication, *Lake stages, *Nutrients, *Fertilization, Water quality control, Algae, Algal control, Aquatic algae, Aquatic plants, Phosphorus, Nitrogen, Biocontrol, Cycling nutrients, Groundwater, Agricultural runoff, Water pollution, Fallout.

Lake eutrophication is water quality degradation resulting from the direct or indirect effects of excessive fertilization. Excessive fertilization increases the primary productivity of a lake causing excessive growth of algae and rooted aquatic plants. This increased plant growth in turn results in unsightly scums, oxygen depletion, unpleasant water tastes, unpleasant odors, a reduction in recreational and fishing value, and other detrimental effects. Fertilization provides increases in needed plant nutrients such as nitrogen and phosphorus. Most lake restoration actions are designed to reduce the levels of nutrients available in lake surface wastes. Nutrients may come into a lake from either point or nonpoint sources. A point source has a clearly defined unit such as a pipe or a sewage treatment plant outlet. A nonpoint source is a nonspecific area from which nutrients are exported such as croplands. Groundwater, surface water, precipitation, and dry fallout are all transport vectors for nutrients. The nutrient levels in a lake are also dependent on the degree of internal nutrient recycling. Most lakes are nutrient traps storing large amounts of nutrients in bottom sediments. The release of these trapped sediments is seasonal due to thermal stratification. Restoration techniques to limit the amount of nutrients available in a lake fall into three categories: (1) reduction of nutrient inflow, (2) disruption of the internal nutrient cycle, and (3) acceleration of nutrient outflow. An alternate restoration approach is 'biomanipulation', using lake fertility for beneficial biological production such as increased fish populations. (See also W80-02773) (Seigler-IPA)
W80-02787

LAKE MEASUREMENTS,
Michigan State Univ., East Lansing. Inst. of Water Research.
D. L. King.
In: Lake Restoration, Report No EPA 440/5-79-001, p 71-76, 1979. 3 Fig, 39 Ref.

Descriptors: *Eutrophication, *Watershed management, *Water pollution control, Runoff, Storm runoff, Dredging, Phosphorus, Dissolved oxygen, Water quality control, Lakes, Lake stages, Watersheds(Basins), Drainage water, Aquatic plants, Aquatic algae, Project planning.

Preparing a comprehensive plan for the renovation of a nutrient-enriched lake require the collection and interpretation of basic data. Special consideration must be given to lake drainage basin characteristics since the drainage basin largely determines the fate of the lake. The first step in the formulation of a renovation plan is to define the problem. The primary factor in lake water quality problems is increased phosphorus concentration which causes too many algae, too many macrophytes, and too little dissolved oxygen. After the problem has been defined, the source of the problem needs to be identified. This can be accomplished by characterizing the lake, characterizing the drainage basin, and performing calculations based on the characterizations. The next step is the control of the problem. The best control strategy is to reduce phosporus input by controlling runoff from the drainage basin. Control methods include strict zoning, sediment basins on tributaries, greenbelts, diversion, dilution, better stormwater handling, and using porus pavement in urban areas. In-lake control methods include dredging, physical and chemical treatment of sediments, artificial aeration, dilution, biological manipulation, and algae poisoning and harvesting. The cost of preparing a plan is difficult to determine due to the great differences in lakes, lake basins, and lake problems. (See also W80-02773) (Seigler-IPA)
W80-02788

MINE DRAINAGE IMPACT ON WATER QUALITY AND ECOSYSTEM ENERGETICS IN A WESTERN PENNSYLVANIA STREAM,
Illinois Inst. of Tech. Chicago. Pritzker Dept. of Environmental Engineering.
W. J. Mitsch, and R. D. Letterman.
In: Surface Mining and Fish/Wildlife Needs in the Eastern United States, Report No FWS/OBS-78/81 A, p 99-106, 1979. 1 Fig, 4 Tab, 25 Ref.

Descriptors: *Pennsylvania, *Watersheds(Basins), *Mine drainage, *Mine acids, Water pollution, Iron compounds, Ecosystems, Food chains, Food webs, Water sampling, Dissolved oxygen, Energy budget, Turbidity, Water temperature, Sulfates, Environmental effects.

Physical, chemical, and biological components of the Ben's Creek Watershed were measured to assess the impact of acid mine drainage on the watershed. The watershed area is approximately 127 km sq and is a part of the Kiskiminetas drainage basin, a tributary to the Allegheny River. Due to the relatively short mine drainage reach an upstream-downstream study was possible. Ferric hydroxide deposition and ecosystem energetics were calculated for the stream. Weekly water samples were collected from 15 stations from June through August 1976. Samples were analyzed for dissolved oxygen, pH, temperature, alkalinity, acidity, turbidity, total solids, dissolved solids, conductivity, total iron, ammonia nitrogen, hardness, sulfate, and trace metal content. Other areas monitored were flowrate, macroinvertebrate benthic population, and fish types. Samples were also taken at the two main mine drainage outlets, Rock Tunnel and Cauffield Mine. Upstream and downstream food webs and ecosystems were analyzed to estimate equivalent loss of ecosystem energy flow. Results show (1) the pH is only slightly affected near mine discharge areas, (2) acidity does not exceed alkalinity, (3) sulfates increase near mine discharge areas, (4) turbidity increases rapidly near discharge areas then rapidly decreases, and (5) downstream iron content was higher than upstream. (Seigler-IPA)
W80-02810

BIOLOGICAL EVALUATION OF NON-POINT SOURCE POLLUTANTS IN NORTH CAROLINA STREAMS AND RIVERS,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
D. R. Lenat, D. L. Penrose, and K. W. Eagleson.
Biological Series 102, 1979. 168 p, 16 Fig, 51 Tab, 54 Ref.

Descriptors: *Water quality, *Biological studies, *Benthic flora, *Benthic fauna, *Water pollution, *Non-point source pollution, *Aquatic life, *Water pollution sources, *North Carolina, Federal Water Pollution Control Act, Stream pollution, Sedimentation, Runoff, Agricultural runoff, Mining runoff, Habitats, Baseline studies, Rivers, Microorganisms, Biotic index, Shannon-Weiner index.

This study analyzes the effects of non-point source pollution by benthic community counts at points along selected North Carolina mountain and Piedmont streams. The study was undertaken as part of a regionwide Section 208 Water Quality Management Plan. The thesis of the study is that greater benthic community diversity occurs in streams less 'stressed' by sediment, runoff, and toxin loads. Samples were selected at streampoints using the 'kick' method, employing a net positioned on the streambed, while a one square meter area upstream of the net is disturbed. Data were gathered and classified by individual species, taxonomic group, and single individuals. In general, unstressed mountain streams yield richer benthic samples than Piedmont streams. In urban streams near Asheville, Winston-Salem and Raleigh, where urban runoff and toxic wastes present water quality problems, species counts were significantly lower than on unstressed streams. Agricultural development leading to runoff produced low counts mainly near streams in areas with no erosion control and no buffer zones between the activity and the stream. Similarly high levels of sediment input from construction and mining produced low counts for a year after the end of the activity, whereupon community counts began to approach normal levels (Arnold-NC)
W80-02871

SEDIMENTS, WATER AND FOOD CHAINS AS SOURCES OF CHLORINATED HYDROCARBONS FOR BENTHIC ORGANISMS IN THE MEDITERRANEAN SEA,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W80-02937

REDUCING LEVELS OF MIREX, AROCLOR 1254, AND DDE BY TRIMMING AND COOKING LAKE ONTARIO BROWN TROUT (SALMO TRUTTA LINNAEUS) AND SMALLMOUTH BASS (MICROPTERUS DOLOMIEUI LACEPEDE),
New York State Dept. of Environmental Conservation, Rome.
J. C. Skea, H. A. Simonin, E. J. Harris, S. Jackling, and J. J. Spagnoli.
Journal of Great Lakes Research, Vol 5, No 2, p 153-159, 1979. 6 Tab, 6 Ref.

Descriptors: *Pesticide residues, *Brown trout, *Smallmouth bass, DDE, DDT, Polychlorinated biphenyls, Aroclors, Foods, Chemical analysis, Lake Ontario, Gas chromatography, Path of pollutants, Chlorinated hydrocarbon pesticides, *Mirex, *Food preparation.

Trimming of Lake Ontario smallmouth bass (Micropterus dolomieui) and brown trout (Salmo trutta) was found to reduce levels of mirex, Aroclor 1254, and DDE by 43% to 64%. trimming included the removal of the skin, doreal and ventral fat, and the entire lateral line. Of the cooking methods tested (smoking, broiling, baking, and deep frying), only deep frying produced consistently high reduction of all three contaminants. (Deal-EIS)
W80-02938

LEVELS OF CHLORINATED HYDROCARBONS IN MARINE ANIMALS FROM THE CENTRAL MEDITERRANEAN,
Catania Univ. (Italy). Ist. di Chimica e Chimica Industriale.
For primary bibliographic entry see Field 5B.
W80-02939

CONTAMINATION OF THE MEDITERRANEAN BLUE AND WHITE DOLPHIN BY ORGANOCHLORINE COMPOUNDS (IN FRENCH),
Institut Scientifique et Technique des Peches Maritimes, Nantes (France).
For primary bibliographic entry see Field 5A.
W80-02940

THE TEMPERATURE AND OXYGEN LETHAL LIMITS OF ACARTIA CLAUSI GIESBRECHT IN A POLLUTED MARINE ECOSYSTEM,
Athens Univ. (Greece). Dept. of Zoology
For primary bibliographic entry see Field 5A.
W80-02941

A SUMMARY OF THE EFFECTS OF URBAN WASTES (MARSEILLE-CORTIOU) ON THE ZOOPLANKTONIC POPULATION OF THE NERITIC ZONE (IN FRENCH).

Groupe Equipe Pollution Pelagique de Marseille (E.P.O.P.E.M.) Aix-Marseille-2 Univ. (France). Lab. d'Hydrobiologie.
For primary bibliographic entry see Field 5B.
W80-02942

DISTRIBUTION AND EVOLUTION OF BENTHIC POPULATIONS OF THE GULF OF IZMIR (INTERIOR PART) SUBJECTED TO MULTIPLE TYPES OF POLLUTION (IN FRENCH),
Ege Univ., Izmir (Turkey). Dept. d'Oceanographique Biologique.
A. Kocatas.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique de la Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkey, p 417-421, 1979. 2 Fig, 2 Tab, 3 Ref, (English Summary).

Descriptors: *Water pollution effects, *Benthos, On-site-investigations, Dominant organisms, *Domestic wastes, *Industrial wastes, Mediterranean, *Gulf of Izmir, Turkey, Water temperatures, Dissolved oxygen, Nutrients, Polychaetes, Diversity index, Animal populations.

During a 15 month period (June 1977 - August 1978) physico-chemical parameters and benthic sampling were realized at 10 stations in the interior part of the Gulf of Izmir under the influence of various pollutions. Also, investigations carried out in 1971-1972 and 1974-1975 have permitted us to follow the preliminary evolution of benthic populations of the Gulf. The studies indicate that the benthic populations decline progressively to the east (into the harbor). The interior part of the Gulf of Izmir is practically abiotic. (Katz-EIS)
W80-02943

STUDIES IN REGARD TO DIFFERENT TYPES OF ACTION OF DETERGENTS ON MARINE SPECIES (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
For primary bibliographic entry see Field 5A.
W80-02944

LETHAL AND SUBLETHAL EFFECTS OF MERCURY SALTS ON MONODONTA ARTICULATA,
Royal Univ. of Malta, Valletta. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-02946

NEW DATA ON THE DISTRIBUTION OF POLLUTANTS AND THEIR EFFECT ON SOME HYPONEUSTON CONSTITUENTS IN THE S.E. MEDITERRANEAN,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
For primary bibliographic entry see Field 5A.
W80-02948

ACCUMULATION OF MANGANESE IN DONAX TRUNCULUS L. (BIVALVIA),
Modena Univ. (Italy). Inst. of Zoology.
For primary bibliographic entry see Field 5B.
W80-02949

THE ROLE OF ZOOPLANKTON FECAL PELLETS IN TRANSPORTING PCBS FROM THE UPPER MIXED LAYER TO THE BENTHOS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W80-02950

ARSENIC FLUX THROUGH MUSSELS AND SHRIMP,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W80-02951

PCBS AND CHLORINATED PESTICIDES IN ORGANISMS FROM THE LIGURIAN SEA,
Genoa Univ. (Italy). Ist. di Chimica Generale.
For primary bibliographic entry see Field 5B.
W80-02955

RELATIONSHIP OF CADMIUM-INDUCED HYPOCALCEMIA WITH MORTALITY IN RAINBOW TROUT (SALMO GAIRDNERI) AND THE INFLUENCE OF TEMPERATURE ON TOXICITY,
Concordia Univ., Montreal (Quebec). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W80-02956

ESTIMATING RATE CONSTANTS FOR THE UPTAKE AND CLEARANCE OF CHEMICALS BY FISH,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
For primary bibliographic entry see Field 5B.
W80-02959

DIFFERENCE IN TASTE BETWEEN THE RIGHT AND LEFT SIDES OF TAINTED FISH,
Domtar Ltd. Research Centre, Senneville (Ontario).
A. J. Liem, and V. A. Naish.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1412-1413, 1979. 2 Tab, 1 Ref.

Descriptors: *Rainbow trout, *Taste, *Pulp wastes, Fish physiology, Path of pollutants, Commercial fish, Bioassay, Mode of action, Water pollution effects, Chemical wastes, Kraft pulping wastes, *Tainting, *Tissue analysis.

More tainting was found on the left than on the right side of rainbow trout (Salmo gairdneri) that were exposed to a kraft pulp mill 'foul condensate.' This sidedness was deduced from the results of the triangle taste test used to detect differences between exposed and control fish, and was observed when the tainting was moderate, in the range of effluent concentrations of 0.015-0.046% by volume. (Deal-EIS)
W80-02961

HEAVY METALS IN THE NATIVE OYSTER (OSTREA ANGASI) AND MUSSEL (MYTILUS EDULIS PLANULATUS) FROM PORT DAVEY, SOUTH-WESTERN TASMANIA,
Tasmanian Fisheries Development Authority, Taroona.
For primary bibliographic entry see Field 5A.
W80-02963

HISTORIC TRANSFORMATIONS OF FISH COMMUNITIES IN THREE GREAT LAKES BAYS,
Toronto Univ. (Ontario). Inst. for Environmental Studies.
T. H. Whillans.
Journal of Great Lakes Research, Vol 5, No 2, p 195-215, 1979. 7 Fig, 5 Tab, 95 Ref.

Descriptors: *Fish populations, *History, *Great Lakes, Biological communities, Water pollution effects, Habitats, Water temperature, Water circulation, Benthos, Benthic fauna, Bottom sediments, Water quality, Commercial fishing, Adaptation, Silting, Plankton, Water pollution sources, Lake Ontario, Lake Erie, Toronto Bay, Burlington Bay, Inner Long Point Bay.

Fish community transformation is investigated for the period from early settlement to the present in Toronto and Burlington Bays, Lake Ontario, and Inner Long Point Bay, Lake Erie. Extensive historic documentation and interviews are combined as case histories detailing changes in fish communities due to changes in water levels, temperature, shoreline configuration, circulation, inflow, watershed conditions, bathymetry, bottom materials, siltation, water conditions, aquatic macrophytes, plankton, benthic invertebrates, stocked fish, commercial and sport fishing. The most stressful perturbations were shoreline and benthic modifications in Toronto Bay, deteriorating water conditions in Burlington Bay, and exploitation in Inner Long Point Bay. Differences between responses of pelagic migrants and near-shore residents to stress appeared to vary according to preadaptation of the species and the flexibility of its life pathways. The overall transformations of the communities have some similarities between time periods and from community to community. (Deal-EIS)
W80-02964

ENTRAINMENT AND IMPINGEMENT OF FISH BY POWER PLANTS IN THE GREAT LAKES WHICH USE THE ONCE-THROUGH COOLING PROCESS,
Fisheries and Marine Service, Sault Ste. Marie (Ontario). Great Lakes Biolimnology Lab.
For primary bibliographic entry see Field 5A.
W80-02965

EFFECTS OF OIL TRANSFERRED FROM INCUBATING GULLS TO THEIR EGGS,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
For primary bibliographic entry see Field 5B.
W80-02967

EFFECTS OF TEMPERATURE ON THE GROWTH AND SURVIVAL OF THE EUROPEAN EEL, ANGUILLA ANGUILLA L.,
Central Electricity Generating Board, Ratcliffe-on-Soar (England). Freshwater Biology Unit.
For primary bibliographic entry see Field 5A.
W80-02968

TRACE METALS IN FUCOID ALGAE AND PURPLE SEA URCHINS NEAR A HIGH ARCTIC LEAD/ZINC ORE DEPOSIT,
British Columbia Research Council, Vancouver.
For primary bibliographic entry see Field 5B.
W80-02969

LABORATORY EXPERIMENTS ON THE EFFECTS OF CRUDE OIL ON THE RED SEA CORAL STYLOPHORA PISTILLATA,
Tel Aviv Univ. (Israel). Dept. of Zoology.
B. Rinkevich, and Y. Loya.
Marine Pollution Bulletin, Vol 10, p 328-330, 1979. 2 Tab, 16 Ref.

Descriptors: *Oil, *Toxicity, *Coral, Mode of action, Reproduction, Animal physiology, Oil pollution, Oil spills, Mortality, Benthic fauna, Organic compounds, *Crude oil, *Tissue analysis.

Sub-lethal detrimental effects of Iranian crude oil were studied on the hermatypic coral Stylophora pistillata in a long term laboratory experiment. The experimental system consisted of four 1500 l. capacity tanks, two of which were periodically polluted. A significant decrease in the number of female gonads per polyp were recorded in 75% of the colonies in the polluted tanks. It is concluded that chronic-oil pollution damages the reproductive system of scleractinian corals. (Deal-EIS)
W80-02970

DDTS IN MARINE FISHES FOLLOWING TERMINATION OF DOMINANT CALIFORNIA INPUT: 1970-77,
California Univ., Los Angeles. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5B.
W80-02971

TOXICITY OF SOLUBLE COPPER AND OTHER METAL IONS TO ELODEA CANADENIS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 5A.
W80-02980

DISTRIBUTION OF ESSENTIAL AND TOXIC METALS IN THE TERRESTRIAL GASTROPOD ARION ATER,
University Coll. of Wales, Aberystwyth. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02981

ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS IN BIRD EGGS FROM THE FALKLAND ISLANDS AND NORTH GERMANY, (IN GERMAN),
Hamburg Univ. (Germany, F. R.). Zoologisches Inst.
For primary bibliographic entry see Field 5B.
W80-02982

DISTRIBUTION OF COBALT 60 IN A MOLLUSC, A CRUSTACEAN AND A FRESHWATER TELEOST: VARIATIONS AS A FUNCTION OF THE SOURCE OF POLLUTION AND DURING ELIMINATION,
CEA Centre d'Etudes Nucleaires de de Cadarache, Saint-Paul-les Durance (France). Dept. de Protection.
For primary bibliographic entry see Field 5A.
W80-02984

MECHANISM OF DDT RESISTANCE IN LARVAE OF THE MOSQUITO AEDES AEGYPTI L.; THE EFFECT OF DDT SELECTION,
Victoria Univ. of Manchester (England). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-02985

THE GILL SIALIC ACID CONTENT AS AN INDEX OF ENVIRONMENTAL STRESS IN RAINBOW TROUT, SALMO GAIRDNERI, RICHARDSON,
Genova Univ. (Italy). Inst. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02988

EFFECTS OF TEMPERATURE AND FOOD ON DEVELOPMENTAL TIMES AND GROWTH IN DAPHNIA OBTUSA KURZ AND SIMOCEPHALUS VETULUS (O. F. MULLER) (CRUSTACEA, CLADOCERA),
Istituto Italiano di Idrobiologia, Pallanza.
For primary bibliographic entry see Field 5A.
W80-02990

CHEMICAL COMPOSITION OF TAIWAN'S OYSTERS AND CLAMS,
Kaohsiung Inst. of Marine Technology (Taiwan).
For primary bibliographic entry see Field 5A.
W80-02992

THE CARBON BALANCE IN AN EXPERIMENT REGARDING THE BACTERIAL BIODEGRADATION OF A TOPPED CRUDE OIL (IN FRENCH),
Laboratoire de Cryptogamie du MNHN, Paris (France).
For primary bibliographic entry see Field 5B.
W80-02993

5D. Waste Treatment Processes

WATER REUSE AND RECYCLING VOLUME 2: EVALUATION OF TREATMENT TECHNOLOGY.
Culp/Wesner/Culp, El Dorado Hills, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-131469, Price codes: A99 in paper copy, A01 in microfiche. Office of Water Research and Technology Report No OWRT/RU-79/2 (1979). 714 p, 164 Fig, 181 Tab, 29 Ref, 5 Append. OWRT R-0087 (7803)(1).

Descriptors: *Water reuse, *Waste water treatment, *Recycling, Water conservation, Water costs, Water supply, Water utilization, Reclaimed water, Sewage treatment, Treatment facilities, Effluents, Cost-benefit analysis, Cost analysis, Industrial water.

Beneficial uses for reclaimed waste water and the treatments necessary to produce the needed effluent quality for these uses are examined. Treatment processes are evaluated by: (1) effectiveness of contaminant removal, (2) reliability and operability, (3) cost effectiveness, (4) energy requirements, and (5) sidestream and by-product impacts. The commonly accepted types of reclaimed waste water use are controlled or uncontrolled, direct or indirect, and recycled. If reuse is planned and intentional it is considered controlled. Indirect refers to the 'loss of identity' of a waste water discharge as it flows downstream. Recycled refers to internal reuse of water prior to discharge. Beneficial uses for waste water are identified and requirements for each category are estimated. Eleven basic levels of treatment to yield increasingly improved effluent qualities are identified. Effluent quality from the various treatment systems studied is compared to effluent quality requirements for beneficial uses. Using this comparison, beneficial uses and compatable treatment levels are identified. Graphs are presented evaluating the economic impact of increased levels of waste water treatment for reuse versus the cost of obtaining new water supplies. (Seigler-IPA)
W80-02711

THE INFLUENCE OF AN ANAEROBIC ZONE IN ACTIVATED SLUDGE SYSTEMS ON THE BACTERIAL POPULATION STRUCTURE,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Sciences
D. F. Toerien, H. J. Van Vuuren, D. N. Sadie, and R. P. Tracey.
Water S. A., Vol 5, No 3, p 109-113, July 1979. 2 Fig, 4 Tab, 7 Ref.

Descriptors: *Waste water treatment, *Phosphates, *Nutrient removal, *Anaerobic conditions, Anaerobic bacteria, Aquatic microbiology, Sludge treatment, Activated sludge, Sewage treatment, Eutrophication, Water pollution treatment.

The enhancement of phosphate removal in activated sludge waste water treatment was examined. Progress in this area is important to the control of eutrophication of surface waters. Previous studies indicate that the addition of an anaerobic zone to activate sludge systems makes no difference in the quantity of phosphate removing bacteria in the sludge. Bacteria from activated sludge systems both with and without anaerobic zones were grouped according to selected phenotypic properties to determine whether or not phosphate accumulation is a property of a specific group of activated sludge bacteria. In all 72 bacterial cultures were analyzed and physiological and biochemical reactions were recorded as positive or negative using the API 20E system. The bacterial isolates fell into two main groups at a 50% similarity level. The grouping indicates that the presence or absence of an anaerobic zone does not lead to a selection of specific groups of bacteria. The bacteria were then grouped into clusters at the 82.5% similarity level. Here, signs of selective influences were detected. The occurrence of phosphate-accumulating isolates in the clusters and in the two main groups were determined to see if selection influences were important to phosphate-removal activity. Results show that selective influences do not affect the ratio (1/3) at which phosphate-accumulating organisms occur. (Seigler-IPA)
W80-02750

SIMULTANEOUS BIOLOGICAL NITROGEN AND PHOSPHATE REMOVAL FROM WASTEWATER IN A MODIFIED PHOSTRIP PROCESS,
Institute for Water Research Pretoria (South Africa).
A. R. McLaren.
Water S. A., Vol 5, No 3, p 144-151, July 1979. 3 Fig, 2 Tab, 18 Ref.

Descriptors: *Waste water treatment, *Phosphates, *Nutrient removal, *Nitrogen, Chemical oxygen demand, Aeration, Sludge treatment, Anaerobic conditions, Sewage treatment, Lime, Ammonia, Denitrification, Waste treatment, Phostrip process, Bardenpho process.

The successful simultaneous removal of nitrogen and phosphate from sewage effluent using a modified Phostrip process is reported. The Phostrip process, designed to remove phosphate during biological sewage treatment, uses an acid and/or anaerobic treatment of secondary sludge with a time treatment to precipitate out the phosphate. The modified process included a denitrification reactor, a main aeration stage (split into two separate consecutive basins), a clarifier, and a phosphate stripping stage. The unit was tested with sludge from a pilot plant and with settled sewage from the Daspoort, Pretoria, sewage treatment plant. A modified Bardenpho process was also tested with the sludge. With this process the two anaerobic reactors were placed ahead of the denitrification stage and the sludge stripper separator was removed. Both processes demonstrated good chemical oxygen demand removal. The modified Phostrip process produced a high degree of nitrogen removal using only influent sewage organics as hydrogen donors. Normal phosphate removal levels were not reduced. The Bardenpo process also produced excellent phosphate and nitrogen removal. The modified Phostrip process has potential for application where influent sewage composition is not favorable for pure biological phosphate removal. (Seigler-IPA)
W80-02754

PROCEEDINGS -- WATER REUSE SYMPOSIUM, MARCH 25-30, 1979, WASHINGTON, D.C. VOLUMES 1, 2, AND 3,
Available from American Water Works Association Research Foundation Denver, Colorado, $15.00/Set, 1979. 2391 p, 678 Fig, 369 Tab, 1140 Ref.

Descriptors: *Water reuse, *Waste water treatment, *Water conservation, Industrial water, Municipal water, Irrigation water, Return flow, Reasonable use, Agriculture, Environmental effects, Water utilization, Drainage water, Reclamation, Salvage value.

The 155 papers presented at the symposium are given. The symposium's central theme was 'water reuse -- from research to application' in the areas of agricultural, municipal, and industrial waste waters. Poster presentations were used and photographs of some posters are included. The papers as a whole show that interest in waste water reuse is global, that recycling is applicable to a broad range of functions, that water reuse is situation-dependent, and reuse is an important conservation measure. The papers are grouped into the categories of: (1) water reuse policy, implementation and potential, (2) water supply augmentation, (3) industrial recycling and reuse, (4) planning for reuse, (5) aquiculture, wetlands, and eco-systems, (6) international developments, (7) institutional factors, (8) treatment R and D/operations, (9) municipal reuse, (10) modeling, monitoring and instrumentation, (11) agricultural reuse, and (12) health and quality considerations. (Seigler-IPA)
W80-02760

AQUACULTURAL APPROACHES TO WASTEWATER NUTRIENT RECYCLING,
California Univ., Los Angeles. Dept. of Biology.
M. S. Gordon, and D. J. Chapman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-135130, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, July 1979. 48 p, 2 Fig, 22 Tab, 37 Ref. OWRT C-7052 (6206)(1) 14-34-0001-6206.

Descriptors: *Aquiculture, *Waste water treatment, *Algae, *Scenedesmus, *Daphnia, Crustaceans, Minnows, Agriculture, Biomass, Food chains, Carnivores, Herbivores, Nutrients, Productivity, Fertilization, Nutrient requirements.

Five years of laboratory scale studies were conducted to access the potential of waste water aqui-

culture as a means of (1) developing a basis for a freshwater aquiculture industry in the U.S., (2) producing salable foods or other commodities to improve waste treatment plant economics, (3) reducing agricultural energy costs by eliminating fertilization needs, and (4) improving the quality of waste treatment plant discharges. Sequential monocultures of waste water based food chains were investigated using unicellular green algae, herbivorous cladoceran crustaceans, and carnivorous and herbivorous teleost fishes. All waste water used for the studies was fully secondarily treated, chlorinated, and dechlorinated. The general approach was for low technology, simple procedures and equipment, and minimal operator skills requirements. Results of the studies are presented in detail, however, materials and methods used are published elsewhere. Study results show that the use of artificial food chains for tertiary waste water treatment is feasible for the reduction of nutrient loading and for the production of valuable protein sources. The algal culture studied, Scenedesmus, was found to be highly sensitive to temperature, light, pH, and iron levels. The best group of cladoceran species tested for growth on Scenedesmus was Daphnia magna giving a food conversion efficiency of greater than 10%. Minnows and shiners can be grown of either live or dried daphnids. (Seigler-IPA)
W80-02764

INSTITUTIONAL STRUCTURES AFFECTING ON-SITE WASTE DISPOSAL IN MAINE,
Maine Univ. at Orono. Life Sciences and Agriculture Experiment Station.
G. K. White, and J. D. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134687, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, Bulletin 761, September 1979. 48 p, 1 Fig, 3 Tab, 54 Ref. OWRT-A-046-ME(2).

Descriptors: *Maine, *Sewage disposal, *Regulation, *Legal aspects, Monitoring, Zoning, Standards, Land use, Sewerage, Sewage treatment, Waste water disposal, Environmental sanitation, Septic tanks, Waste treatment, Plumbing.

Three main State-level agencies involved in sewage disposal regulations in Maine are the Land Use Regulation Commission; the Department of Environmental Protection (DEP); and the Department of Human Services, Division of Health Engineering. The Land Use Regulation Commission grants permits for the development of private sewage disposal systems to applicants who meet the requirements of the Maine Plumbing Code and who: (1) plan to build on tested suitable soil, (2) have the necessary financial ability, (3) have the necessary technical ability, and (4) plan to meet the minimum lot size standards. The DEP enforces water pollution control laws, licenses and monitors effluents, and assists in disposal planning. The Division of Health Engineering is the major agency regulating sub-surface disposal. Advances and newly developed techniques have brought about many regulatory changes with older less comprehensive test methods being replaced by newer more rigorous investigations and site evaluations. Some local communities have even adopted standards more stringent that the State's. The Maine Plumbing Code is used as a regulatory device for land development. The Code was adopted in 1926 and has been revised frequently due to experience with technical problems and various legislative moves to handle these problems. Some areas of the Code are discussed in detail along with various disposal alternatives that are permitted. A brief national sewage disposal perspective is also presented. (Seigler-IPA)
W80-02765

TREATMENT OF DOMESTIC WASTES IN LAKESHORE DEVELOPMENTS,
Wisconsin Univ., Madison.
R. J. Otis.
In: Lake Restoration, Report No EPA 440/5-79-001, p 95-102, 1979. 8 Fig, 40 Ref.

Descriptors: *Septic tanks, *Waste water disposal, *Eutrophication, Lakes, Lake shores, Sewage disposal, Filtrations, Domestic wastes, Water pollution sources, Evapotranspiration, Soil water movement, Soil types, Nutrients.

Septic tanks are the most common method used for the disposal of sewage from private homes surrounding lakes. On suitable soils with a well designed, installed, and maintained system, septic tanks are an effective and cost-efficient sewage disposal method. However, as much as 68% of U.S. land is unsuitable for septic tanks and even on suitable soils they are often poorly designed, installed, and maintained. Along lakeshores this results in nutrient loading of the lake. The most often suggested solution to this problem is the installation of a conventional gravity sewer system. However, for lakeshore communities, this is often impractical due to the small number of people and the high costs involved. Onsite systems are the most effective alternative to conventional systems. Onsite systems include well designed and maintained septic tanks, mound systems, sand filters, evapotranspiration beds, wastewater modification, and grey water management. Good management and maintenance are the keys to success of onsite disposal systems. A public management authority with trained personnel to properly operate and maintain systems would be a valuable and cost efficient method of solving lakeshore sewage problems. (See also W80-02773) (Seigler-IPA)
W80-02791

PROGRESS IN WASTEWATER DISINFECTION TECHNOLOGY, PROCEEDINGS OF THE NATIONAL SYMPOSIUM, CINCINNATI, OH, SEPTEMBER 18-20, 1978.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 338, Price codes: A13 in paper copy, A01 in microfiche. Report No EPA-600/9-79-018, June 1979, Edited by Venosa, A.D., 294 p, 2 Append.

Descriptors: *Disinfection, *Waste water treatment, *Ozone, *Chlorination, *Ultraviolet radiation, Sewage effluents, Water sampling, Coliforms, Analytical techniques, Organic compounds, Pilot plants, Waste water(Pollution), Chlorine, Efficiencies, Viruses, Aquatic microorganisms, E. coli, Environmental effects.

Twenty papers on the latest in waste water disinfection were presented at the symposium by scientists, consulting engineers, municipal design engineers, and various technical government officials. Following the presentation of most of the papers, a five minute question and answer session was held. Text of these sessions are provided at the end of the papers. The symposium had six major topic sessions: (1) chlorination/dechlorination, (2) chlorine dioxide, (3) ultraviolet light, (4) ozone, (5) viruses and organics, and (6) planning and implementation. Following all but the last session, a 30 to 75 minute roundtable discussion was held and these discussions are included in the proceedings. Overall symposium conclusions are: (1) rapid progress is being made in waste water disinfection; (2) chlorine usage savings are possible with optimized mixing; (3) sulfur dioxide dechlorination is cost effective, but not with actived carbon or holding lazons; (4) a bubble diffuser contractor is best for disinfection of well oxidized, filtered secondary effluent; (5) ozone disinfection is twice as costly as chlorine; (6) ultraviolet light disinfection is promising; (7) interesting results are being found on nonvolatile organic by-product formation by chlorine, ozone, and ultraviolet light. (See W80-02813 thru 02831) (Seigler-IPA,
W80-02812

FIELD STUDIES IN OPTIMIZATION OF WASTEWATER CHLORINATION,
California Dept. of Health Services, Berkley.
E. Sepp, P. Bao, and A. Custodio.
In: Progress in Wastewater Disinfection Technology Report No EPA-600/9-79-018, p 7-11, 1979. 6 Fig, 3 Ref.

Descriptors: *Waste water treatment, *Chlorination, *Coliforms, *Sewage bacteria, California, Domestic wastes, Sewage, Pilot plants, Industrial wastes, Sludge, Bacteria, Chlorine, Nitrification, Disinfection, Optimization.

Three chlorination studies conducted by the California Department of Health Services were designed to reduce chlorine induced toxicity and to produce a savings in chlorine use. Three mobile units were used in the studies: a chlorination pilot plant, a fish bioassay laboratory, and a public health laboratory. The pilot plant features rapid initial mixing, automatic control of chlorine dosage by residual control, and plug flow contact chambers to provide a variety of contact times. The first study was at a San Leando activated sludge plant where plant flow was almost 50% industrial wastes. Many problems occurred and bacterial results from the pilot were not noticeably better than those from the full scale plant. An activated sludge plant at San Pablo which uses roughing trickling filter and complete nitrification was used for the second study. Here, the pilot plant produced the same level of disinfection with a lower chlorine dosage. The third study used the Pinole activated sludge plant which treats entirely domestic wastes. Here, the pilot plant again required a lower chlorine dosage and produced fewer residuals. Coliform survival data are plotted for the pilot plant and the full scale plants in all three studies. Text of a brief discussion on the information presented is included. (See also W80-02812) (Seigler - IPA)
W80-02813

COMPARISON OF ACUTE TOXICITY OF CHLORINATED EFFLUENTS FROM OPTIMIZED AND EXISTING FACILITIES,
California State Dept. of Fish and Game, Rancho Cordova. Pollution Control Lab.
B. J. Finlayson, and R. J. Hansen.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 12-23, 1979. 9 Fig, 3 Tab, 20 Ref.

Descriptors: *Toxicity, *Chlorination, *Waste water treatment, *Pilot plants, California, Water pollution effects, Disinfection, Nitrification, Shiners, Minnows, Chlorine, Effluents, Optimization.

The California Department of Fish and Game is using a specially designed mobile laboratory to monitor the toxicity of chlorinated waste water from existing treatment plants and from a chlorination optimizing pilot plant. Existing waste water treatment plants involved are the San Pablo and Pinole plants. The mobile laboratory is housed in an 8 by 2.7 m trailer. Total laboratory cost is approximately $30,000. The mobil unit has three areas, a water control room, a bioassay room, and a laboratory. Standard 96-h continual-flow bioassay methods are used to test toxicity on fathead minnows and golden shiners. Comparison of toxicity results from the existing plants and the pilot plant shows that in all cases residuals from the pilot plant were lower. Therefore, it appears that the pilot plant does use chlorine more efficiently and reduces effluent toxicity. Fathead minnows were found to be more sensitive to chlorine than shiners. Fathead minnows are also more sensitive to nitrified and ammoniated effluents. Nitrification of waste waters before chlorination does reduce the toxicity of the chlorine residuals. Text of a brief discussion on the paper is also presented. (See also W80-02812) (Seigler - IPA)
W80-02814

DESIGN OF A CHLORINATION SYSTEM FOR LAGOON DISINFECTION,
Utah Water Research Lab., Logan.
B. A. Johnson, J. H. Reynolds, J. L. Wight, and E. J. Middlebrooks.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 24-35, 1979. 14 Fig, 1 Tab, 19 Ref.

Descriptors: *Chlorination, *Waste water treatment, *Mathematical models, *Sewage lagoons, Bacteria, Coliforms, Effluents, Disinfection, Sewage bacteria, Chlorine, Dissolved oxygen, Algae, Utah, Biochemical oxygen demand.

A mathematical model to represent the effects of chlorination of lagoon effluents and to predict the necessary chlorine dosages was developed from data collected during a 12 month study at a field scale waste stabilization lagoon facility. The test

facility at Logan, Utah, has four chlorination systems. Chlorinated samples were tested for total and fecal coliforms, ammonia, biochemical oxygen demand, dissolved oxygen, sulfide, suspended solids, pH, temperature, turbidity, and other water quality factors. Total coliform removal efficiency is plotted as a function of total chlorine residual at various contact times. Both filtered and unfiltered lagoon effluents were studied. Results show that increasing total chlorine residual produces increased total and fecal coliform reduction for both filtered and unfiltered effluents. The mathematical model predicts chlorine dose, contact time, and chlorine residual for adequate disinfection. Design curves for selecting chlorine doses and contact times for desired disinfection levels were constructed by applying the model. The equations used to develop the design curves are provided. Two examples of curve application are presented. Text of a brief discussion on the paper is also presented. (See also W80-02812) (Seigler - IPA)
W80-02815

DECHLORINATION OF WASTEWATER: STATE-OF-THE-ART FIELD SURVEY AND PILOT PLANT STUDIES,
Los Angeles County Sanitation Districts, CA.
H. B. Gan, C. Chen, and A. D. Venosa.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 36-48, 1979. 9 Fig, 11 Tab, 2 Ref.

Descriptors: *Chlorination, *Waste water treatment, *Sulfur compounds, Pilot plants, Effluents, Sewage bacteria, Chlorine, California, Ponds, Activated carbon, Environmental effects, Waste water(Pollution), Coliforms, Sludge.

A field survey of dechlorination installations in California was conducted to access their effectiveness and reliability. Survey data were collected by questionnaires and on-site visits. Results show that sulfur dioxide is the most commonly used dechlorinating agent due to low cost and ease of application. Most dechlorination facilities were installed after January 1976 at secondary treatment plants due to California's recent strict waste water treatment requirements. Approximately 94% of the facilities operate continuously 24 hours a day. Other survey results and percentages are provided in tabular form. Site visits were used to observe various sulfur dioxide feed methods. Pilot plant studies were also conducted to determine bacteriological, physical, and chemical degradation effects after dechlorination. In the pilot plants, three dechlorination methods were studied, sulfur dioxide, granular activated carbon, and holding ponds. As in the field study, sulfur dioxide was the most commonly used method. Comparative cost estimates are given for the three methods. Text of a brief discussion on the paper is also provided. (See also W80-02812) (Seigler - IPA)
W80-02816

EFFECTIVENESS OF CHLORINE DIOXIDE AS A WASTEWATER DISINFECTANT,
Stanford Univ., CA. Dept. of Civil Engineering.
J. D. Berg, E. M. Aieta, P. V. Roberts, and R. C. Cooper.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 61-71, 1979. 6 Fig, 11 Tab, 6 Ref.

Descriptors: *Waste water treatment, *Chlorination, *Disinfection, *Chlorine, Sewage bacteria, Viruses, Aquatic microorganisms, Coliforms, E. coli, Efficiencies, Effluents, Sewage effluents, Waste water(Pollution).

The use of chlorine dioxide as an alternative to chlorine for municipal waste water disinfection is evaluated. Chlorine dioxide is a strong oxidant over a broad pH range, provides a measurable residue, does not react with ammonia, and does not yield trihalomethanes. Membrane filter (MF) and most probable number (MPN) methods for counting bacteria were applied and a computerized comparison was performed. Results show that MPN and MF methods have equivalent accuracy when applied to fecal coliform counts, MF is more 'precise' than MPN, and MF is a more appropriate estimator of realistic conditions. Various experiments were then conducted to determine the factors effecting chlorine dioxide bactericidal efficiency. Results show: (1) suspended solids reduce bactericidal efficiency, (2) pure batch-grown E. coli cultures are more susceptible than native population, and (3) chlorine dioxide and chlorine are nearly equally effective with pure or native cultures of E. coli. Finally, tests were conducted on the virucidal effectiveness of chlorine dioxide. Test results indicate than: (1) chlorine and chlorine dioxide at 5 mg/l in secondary effluent produce the same responses in Poliovirus I and coliphage, (2) chlorine dioxide at all dosages is more effective than chlorine at the highest dosage, and (3) chlorine dioxide is more effective as a virucide than as a bactericide. (See also W80-02812) (Seigler - IPA)
W80-02817

CHLORINE DIOXIDE: ANALYTICAL MEASUREMENT AND PILOT PLANT EVALUATION,
Stanford Univ., CA. Dept. of Environmental Engineering.
E. M. Aieta, B. Chow, and P. V. Roberts.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 72-85, 1979. 7 Fig, 13 Tab, 14 Ref.

Descriptors: *Waste water treatment, *Chlorination, *Disinfection, *Chlorine, Sewage bacteria, Aquatic microorganisms, Coliforms, Efficiencies, Effluents, Waste water(Pollution), Analytical techniques, Volumetric analysis, Pilot plants, Statistical methods.

The use of chlorine dioxide as an alternative to chlorine for wastewater disinfection was investigated. Analytical techniques used in the investigation are described including stock generation techniques, stock measurement techniques, and residual measurement techniques for chlorine and chlorine dioxide. Residual measurement techniques used include ferrous titrimetric determination and amperometric titration. The bactericidal effectiveness of both disinfectants was tested on secondary effluent from the Palo Alto Water Pollution Control Plant. Total coliform bacteria were analyzed by membrane filter technique. Statistical analyses were done to investigate any biases in data due to experiment order or sampling technique. Results indicate: (1) both disinfectants give decreased survival ratios with increased dose or contact time, (2) both disinfectants give essentially the same survival ratios on a mass dose with a 30 minute contact time, (3) for short contact times chlorine dioxide is more effective, and (4) chlorine dioxide provides the same effectiveness as chlorine but produces lower residual concentrations. A disinfection model was designed for both chlorine and chlorine dioxide to allow application of study results to actual waste water treatment situations. Pilot plant studies will be used to verify the model. Text of a brief discussion on the paper is provided. (See also W80-02812) (Seigler - IPA)
W80-02818

EFFECT OF PARTICULATES ON INACTIVATION OF ENTEROVIRUSES IN WATER BY CHLORINE DIOXIDE,
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
F. A. Brigano, P. V. Scarpino, S. Cronier, and M. L. Zink.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 86-94, 1979. 11 Fig, 1 Tab, 33 Ref.

Descriptors: *Waste water treatment, *Disinfection, *Viruses, *Chlorine, Chlorination, Turbidity, Bentonite, Coliforms, Aquatic microorganisms, Effluents, Efficiencies, Analytical techniques, Waste water(Pollution).

The ability of suspended matter (turbidity) and viral aggregates to decrease the effectiveness of chlorine dioxide as a disinfectant for waste water treatment is examined. The importance of disinfectant residuals is also considered due to the ability of coliforms and fecal coliforms to regrow in chlorinated waste water effluents. A laboratory experiment with poliovirus 1 is described including chlorine dioxide measurement, virus quantitation and characterization, poliovirus preparation, bentonite preparation, poliovirus-bentonite complex preparation, cell associated-poliovirus 1 preparation, experimental procedures, and poliovirus assay procedure. Results show that at 5C and a pH of 7, poliovirus aggregates took 2.7 times longer to inactivate than did single state viruses with a chlorine dioxide disinfectant. Bentonite adsorbed-poliovirus 1 single were used to test inorganic turbidity effects. Results show that increasing temperature increases disinfection efficency for unassociated poliovirus singles, however, for bentonite adsorbed-poliovirus 1 single, temperature increases caused disinfection efficiency decreases. Overall, temperature and turbidity were found to affect disinfection rates with bentonite-adsorbed poliovirus while no effect was found in the turbidity levels of cellular-associated virus. Text of a brief discussion on the paper is included. (See also W80-02812) (Seigler-IPA)
W80-02819

UTILITY OF UV 'DISINFECTION' OF SECONDARY EFFLUENT,
Texas A and M Univ., College Station. Dept. of Environmental Engineering.
H. W. Wolf, A. C. Petrasek, and S. E. Esmond.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 100-107, 1979. 12 Fig, 1 Tab, 7 Ref.

Descriptors: *Waste water treatment, *Ultraviolet radiation, *Disinfection, Coliforms, Turbidity, Aquatic microorganisms, Effluents, Efficiencies, Viruses, Suspended solids, Chlorination, Biochemical oxygen demand.

A 16-month project was conducted at the Dallas Water Reclamation Research Center to investigate the adequacy of ultraviolet (UV) light as a secondary waste water disinfectant. A fecal coliform content of 200/100 ml was considered adequate. Two UV generating units were used, a Kelly-Purdy unit and a unit made by Ultraviolet Purification Systems, Inc. Experiments were run on various stages and types of effluent including three virus seeding experiments with poliovirus 1 and F2 coliphage. Stringent sampling and analysis was conducted for many variables including total suspended solids, turbidity, and transmissability. Five runs were made with the Kelly-Purdy unit, however, due to its design there were problems with the accumulation of solids in the tray. Eight runs were then made with the Ultraviolet Purification Systems unit. Data plots are provided for the results which indicate that UV irradiation is a viable alternative disinfection procedure for the criterion of 200 fecal coliforms/100 ml. However, UV effectiveness varies with effluent quality so treatments must be designed to accomodate effluent variations. Text of a brief discussion on the paper is included. (See also W80-02812) (Seigler-IPA)
W80-02820

UV DISINFECTION OF SECONDARY EFFLUENT,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. D. Johnson, K. Aldrich, D. E. Francisco, T. Wolff, and M. Elliott.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 108-116, 1979. 6 Fig, 2 Tab, 3 Ref.

Descriptors: *Waste water treatment, *Ultraviolet radiation, *Disinfection, Coliforms, North Carolina, Aquatic microorganisms, Effluents, Efficiencies, Biochemical oxygen demand, Turbidity, Suspended solids, Water temperature, Potassium.

Various aspects of waste water disinfection by ultraviolet light (UV) were investigated including the use of chemical actinometry to measure UV dosages, the occurrence of photoreactivation in UV treated samples exposed to sunlight, and the effects of water quality parameters on UV disinfection of filtered and unfiltered secondary effluent. UV disinfection is being conducted at a pilot plant in Durham, North Carolina, with two commercial-

ly available UV sterilization units. Lack of consistency in UV dosage determination is a problem. In the investigation, potassium ferrioxalate actinometry was used to measure dosage for disinfection of pure cultures of E. coli in tap water. Actinometry dosages were found to be directly related to the average light penetrated fluid depth and to the average intensity of multiple lamp units. Photoreactivation experiments showed a 1.4 log recovery in total coliforms at 25C. Lower recoveries were found at lower temperatures. Water quality parameter effects are still being studied, but a major influencing parameter appears to be the non-ideal flow patterns of the two units being used. More data analysis is needed to clarify the effects of other parameters. Text of a brief discussion on the paper is included. (See also W80-02812) (Seigler-IPA)
W80-02821

FULL SCALE EVALUATION OF ULTRAVIOLET DISINFECTION OF A SECONDARY EFFLUENT,
Hydroscience, Inc., Westwood, NJ.
O. K. Scheible, G. Binkowski, and T. J. Mulligan.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 117-125, 1979. 12 Fig.

Descriptors: *Waste water treatment, *Ultraviolet radiation, *Disinfection, Coliforms, New Jersey, Effluents, Efficiencies, Chlorination, Light intensity, Photoactivation, Comparative costs, Water sampling, Aquatic bacteria, Thin films.

A thin film ultraviolet (U.V.) disinfection system was installed and evaluated at the Northwest Bergen County Water Pollution Control Plant in Waldwick, New Jersey. The U.V. disinfection unit was installed in an inactive chlorine contact chamber. The unit has 400 germicidal lamps with an output of 30W for each lamp. During June through August, 1978, two randomized sampling series were conducted. The first evaluated unit effectiveness at two flow rates and flow voltages. The second evaluated unit effectiveness at one flow rate with variable lamp operations and voltages. Results indicate that the system did provide effective bactericidal treatment for the water quality conditions at the plant. Costs for this particular system, excluding support structures and ancillary equipment, are estimated to be 0.9 to 1.4 cents per 1,000 gal. Photoreactivation studies were also conducted and significant increases in fecal coliform levels were noted after the exposure of U.V. irradiated samples to visible light. Plots of tests results are provided along with the text of a brief discussion held after the paper was presented. (See also W80-02812) (Seigler-IPA)
W80-02822

COMPARISON OF MPN AND MF TECHNIQUES OF ENUMERATING COLIFORM BACTERIA IN OZONATED WASTEWATER EFFLUENT,
Municipal Environmental Research Lab., Cincinnati, OH.
M. C. Meckes, and A. D. Venosa.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 136-143, 1979. 1 Fig, 8 Tab, 12 Ref.

Descriptors: *Ozone, *Waste water treatment, *Disinfection, Probability, Statistical methods, Coliforms, Efficiencies, Chlorination, Effluents, Sewage bacteria, Sewage effluents, Bacteria, Chlorine, Treatment, Water purification.

Two fecal coliform counting techniques, Most Probable Number (MPN) and Membrane Filter (MF) were compared for ozonated secondary waste water effluent. The code of Federal Regulations has established the MPN method as the method of preference for enforcement situations involving chlorination. However, ozone is being increasingly used for waste water disinfection, and the MF method is rapid, simple, and more economical than the MPN method. The two techniques were compared at different applied ozone levels according to Standard Methods. Six repetitions of each ozone dosage were conducted and separate analyses of variance of the data for total and fecal coliforms were performed. For each analysis, three main effects and four interactive effects were considered. Results indicate no significant difference between the MF and the MPN techniques for counting total and fecal coliforms in secondary ozonated waste water effluent. However, ozone dosage did have a significant effect on the coliform numbers and coliform densities did vary for repetitions. It appears that either technique is an effective means of counting coliforms in ozonated effluents, however, due to the Code of Federal Regulations, approval for the use of the MF technique is still required. Text of a brief discussion on the paper is included. (See also W80-02812) (Seigler-IPA)
W80-02823

COMPARATIVE EFFICIENCIES OF OZONE UTILIZATION AND MICROORGANISM REDUCTION IN DIFFERENT OZONE CONTACTORS,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Lab.
A. D. Venosa, M. C. Meckes, E. J. Optaken, and J. W. Evans.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 144-161, 1979. 18 Fig, 18 Tab, 8 Ref.

Descriptors: *Ozone, *Waste water treatment, *Disinfection, *Coliforms, Ohio, Effluents, Efficiencies, Water sampling, Statistical methods, Water purification, Optimization, Chemical oxygen demand, Ammonia, Turbidity, Water temperature.

Three ozone contactors were compared on the basis of log total and fecal coliform reductions. The contactors were operated in parallel on the same secondary waste water effluent under controlled conditions. The secondary effluent used came from the Robert A. Taft Laboratory, Cincinnati, Ohio, a conventional activated sludge plant. Ozone for disinfection was generated in a plate-type corona discharge ozonator and was then fed to the contactors. After treatment, grab samples were taken and analyzed for total and soluble chemical oxygen demand, organic carbon, Kjeldahl nitrogen, ammonia-nitrogen, nitrite-nitrogen, suspended solids, turbidity, temperature, and pH. Bacteriological analysis samples were assayed for total and fecal coliforms by Standard Membrane Filtration. The contactors tested were a packed column ozone contactor, a pressure injector contactor, and a bubble diffuser ozone contactor. The effect of increasing the carrier gas flow rate/liquid flow rate ratio at a constant concentration of ozone in the carrier gas was tested. Here, overall ozone utilization was highest in the bubble diffuser followed by the packed column. Also tested was the effect of increasing the oxygen in the carrier gas at a constant carrier gas flow/rate liquid flow rate ratio. For these conditions, ozone utilization was again highest in the diffuser. In general, a highly significant log-log correlation was found beozone utilization and coliform reduction with the bubble diffuser best meeting all effluent limitations. (See also W80-02812) (Seigler-IPA)
W80-02824

ECONOMIC EVALUATION OF OZONE CONTACTORS,
Municipal Environmental Research Lab., Cincinnati, OH.
E. J. Opatken.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 162-173, 1979. 1 Fig, 18 Tab, 1 Ref.

Descriptors: *Ozone, *Waste water treatment, *Disinfection, *Cost analysis, Evaluation, Economic efficiency, Efficiencies, Chlorination, Water purification, Pilot plants, Electric power costs, Interest rates, Operating costs, Maintenance costs.

Three ozone contactors, a packed column (PC), a positive pressure injector (PPI), and a bubble diffuser were economically evaluated in parallel waste water disinfection. The bubble diffuser was tested at three different concentrations, 5, 10, and 15 mg/l. Summary cost data and detailed cost sheets were developed from pilot plant results. Ozone cost sheets including operating and overhead cost are presented for the PC, the PPI, and the bubble diffuser at all three concentrations. Significant results are: (1) the bubble diffuser at 10 mg/l had a decided edge over the other concentrations and contactors; (2) the PC appears to be the second best contactor due to an ozone cost advantage; and (3) although ozone is more expensive than chlorine, less ozone is needed for disinfection. Disinfection cost sheets are also presented again showing the bubble diffuser at 10 mg/l to be the most economical. Overall results show the bubble diffuser at 10 mg/l to have the lowest capital investment requirement of $266,000 and the lowest disinfection cost of 11 cents/M gal. (See also W80-02812) (Seigler-IPA)
W80-02825

FIELD SCALE EVALUATION OF WASTEWATER DISINFECTION BY OZONE GENERATED FROM AIR,
M and I, Inc., Fort Collins, CO.
K. L. Rakness, and B. A. Hegg.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 174-197, 1979. 10 Fig, 10 Tab, 2 Ref.

Descriptors: *Ozone, *Waste water treatment, *Coliforms, *Disinfection, Generators, Effluents, Sewage bacteria, Colorado, Waste water(Pollution), Efficiencies, Sewage effluents, Dew point, Air temperature, Electric power demand.

The operation of the ozone waste water disinfection system at the upper Thompson Sanitation districts advanced waste water treatment facility is discussed. The facility in operation since 1976, provides waste water treatment for Estes Park, Colorado. The ozone treatment process utilizes two air-fed ozone generators and a contact basin. To assess the operation of the system, data were collected for chemical and microbiological conditions, ozone in air concentrations, ozone in water concentrations, electrical power consumption, and other parameters. Ozone generation data show that the air pretreatment system performed well, however, high dew points have caused malfunctions and generator damage. An increase in dew point causes decreased ozone generation. The installation of a high dew point alarm is being considered to prevent future problems. Ozone system power requirements are running 30% greater than expected due to lower than design ozone production rates. Power consumption increases dramatically at low ozone production requirements. To be more energy efficient, ozone units must be built with more production level flexibility. Since the original construction of the ozone contacting system several improvements have been made including a contact basin cover, basin exhaust changes, baffle and scum skimmer changes, ozone piping and diffusion replacement, and currently, the construction of an ozone destruct system. When the system is performing well and has operated for several days disinfection is good, however, disinfection is poor during sporadic system operation. (See also W80-02812) (Seigler-IPA)
W80-02826

FIELD-SCALE EVALUATION OF WASTEWATER DISINFECTION BY OZONE GENERATED FROM OXYGEN,
Engineering-Science, Inc., Cleveland, OH.
J. S. Jain, N. L. Presecan, and M. Fitas.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 198-209, 1979. 9 Fig, 5 Tab.

Descriptors: *Ozone, *Wastewater treatment, *Disinfection, *Generators, Coliforms, Effluents, Sewage bacteria, Ohio, Waste water(Pollution), Efficiencies, Sewage effluents, Dew point, Electric power demand, Oxygen.

The Meander Ozonation System at the regional Meander Advanced Wastewater Treatment Facility in Trumball County, Ohio, was evaluated through a U.S. Environmental Protection Agency

funded R and D Study. It is the first U.S. facility using ozone produced from oxygen recycled from the contactor. The ozonators are designed to produce 180 kg/d ozone providing an ozone dosage of 6 mg/l. However, many problems have occurred during installation resulting in a late start-up and unreliable performance. Drying equipment problems have existed since installation including leaks in the refrigeration system, moisture in the drying bed, drying media insufficiency, and after-filter clogging. In the contacting tank, leaks have occurred in the ozone carrying pipes, the pressure/vacuum relief valves have occasionally opened, and gaskets on manholes and hatches have developed leaks. Control problems have occurred with ozone gas flow and production, with the Dasibi ozone meter, with the Delta Scientific dissolved ozone meter, and with the lower explosion limit monitor. It has also been necessary to replace many of the original plastic pipes with copper and stainless steel pipes. Due to all of these problems, only limited operating data have been collected, however, tables are presented for disinfection efficiency, water quality, and ozone generation efficiency. (See also W80-02812) (Seigler-IPA)
W80-02827

VIRUS INACTIVATION IN WASTEWATER EFFLUENTS BY CHLORINE, OZONE, AND ULTRAVIOLET LIGHT,
Carborundum Co., Niagara Falls, NY.
R. A. Fluegge, T. G. Metcalf, and C. Wallis.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 223-232, 1979. 18 Fig, 2 Tab, 3 Ref.

Descriptors: *Waste water treatment, *Disinfection, *Viruses, Coliforms, Chlorination, Ozone, Chlorine, Ultraviolet radiation, Efficiencies, Sewage effluents, Sewage bacteria, Turbidity, Waste water(Pollution), Pilot plants.

The viral inactivation efficiencies of five waste water treatment plants are compared. The plants and their inactivation methods are: (1) the Northwest Bergen County Wastewater Treatment Plant, Waldwick, New Jersey, ultraviolet irradiation; (2) the Estes Park Wastewater Treatment Plant, Estes Park, Colorado, ozone; (3) the Muddy Creek Sewage Works, Cincinnati, Ohio, chlorine; (4) the Marlborough Easterly Wastewater Treatment Plant, Marlborough, Massachusetts, chlorine; and (5) the R. A. Taft Laboratory pilot plant, ozone. A self-contained mobile laboratory with Aquella Virus Concentrators was used to sample the effluent at each site. Samples were analyzed for virus concentration and identification. No major seasonal variations in virus concentrations were found, however, a diurnal variation was found at the Muddy Creek Plant. No correlation was found between any of the standard waste water quality parameters and virus concentrations. Ten different virus types were identified: polioviruses 1, 2, and 3 and Coxaskie, A9, B1, B2, B3, B4, B5, and B6. Overall virus isolation rates and concentrations were significantly reduced by all three disinfection methods. (See also W80-02812) (Seigler-IPA)
W80-02828

EFFECTS OF CHLORINE, OZONE, AND ULTRAVIOLET LIGHT ON NONVOLATILE ORGANICS IN WASTEWATER EFFLUENTS,
Oak Ridge National Lab., TN.
R. L. Jolley, N. E. Lee, W. W. Pitt, M. S. Denton, and J. E. Thompson.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 233-245, 1979. 14 Fig, 5 Tab, 14 Ref.

Descriptors: *Waste water treatment, *Chlorination, *Ozone, *Disinfection, *Ultraviolet radiation, Sewage effluents, Analytical techniques, Chromatography, Chemical analysis, Spectrometers, Mass spectrometry, Chlorine, Coliforms, Organic compounds.

Effluent samples of waste water disinfection by chlorine, ozone, and ultraviolet (UV) light were analyzed to gather data on the effect of the disinfectant agent on nonvolatile organic constituents in the water. Waste water samples from the Oak Ridge West Wastewater Treatment Plant were disinfected by the various agents and were than concentrated by low-temperature distillation and freeze drying. Constituents were separated and identified by chromatography, ultraviolet spectrometry, and mass spectrometry. Ozone disinfection results show that the most rapid destruction of UV-absorbing compounds occurs within the first 3.5 mg/l dosage of ozone. Oxidizable constituents showed some initial destruction that increased with increasing ozone dosage. Waste water disinfection by chlorination also showed much nonvolatile organic constituent destruction along with the production of other nonvolatile compounds. However, disinfection by UV-light irradiation apparently has little effect on nonvolatile chromatographic constituents. Chromatograms illustrating and comparing results for the three disinfection methods are presented. (See also W80-02812) (Seigler-IPA)
W80-02829

MUTAGENIC ACTIVITY OF NONVOLATILE ORGANICS DERIVED FROM TREATED AND UNTREATED WASTEWATER EFFLUENTS,
Oak Ridge National Lab., TN.
R. B. Cumming, L. R. Lewis, R. L. Jolley, and C. I. Mashni.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 246-252, 1979. 3 Fig, 3 Tab, 5 Ref.

Descriptors: *Waste water treatment, *Genetics, *Disinfection, *Chlorination, Ozone, Ultraviolet radiation, Chromatography, Salmonella, E. coli, Bacteria, Chlorine, Tennessee, Sewage effluents, Water sampling, Chromozones.

A strain of Escherichia coli, WP2, and four strains of Salmonella typhinurium were used to test the mutagenic effects of nonvolatile organics resulting from waste water disinfection. Samples were taken from seven waste water treatment plants both before and after the final disinfection treatment. Samples were then shipped to the Oak Ridge National Laboratory for analysis. Clear positive mutagenic results were observed for chlorinated samples from some plants while others showed only negative results. However, this does not mean that these negative result plants are not producing mutagens, rather it means possibly that current testing organisms and procedures do not detect them. Positive mutagenic samples were separated into subsamples by high pressure liquid chromatography. Data from two such separations are presented. Although the testing technology for mutagenicity in waste water effluents is imperfect, there is no doubt about the reality of the problem especially in chlorinated waste water. Due to this potentially serious health hazard, planning for future disinfection plants needs to consider this mutagenic effect. (See also W80-02812) (Seigler-IPA)
W80-02830

PLANNING DECISIONS IN SELECTING WASTEWATER EFFLUENT DISINFECTION FOR THE OLENTANGY ENVIRONMENTAL CONTROL CENTER,
Environmental Protection Agency, Chicago, IL. Region V.
C. F. Grissom.
In: Progress in Wastewater Disinfection Technology, Report No EPA-600/9-79-018, p 258-262, 1979. 1 Fig, 6 Ref.

Descriptors: *Waste water treatment, *Ozone, *Environmental effects, *Disinfection, Chlorination, Ultraviolet radiation, Sewage effluents, Ohio, Chlorine, Insects, Mollusks, Discharge(Water), Aquatic life, Water pollution effects, Olentangy River, Environmental impact statements.

The Environmental Protection Agency's (EPA) rationale for selecting ozonation as the disinfection method for the Olentangy Environmental Control Center, Delaware County, Ohio, is reviewed. EPA prepared an environmental impact statement for the project in 1975. The original proposed waste water treatment facility was a two-stage activated sludge plant, with tertiary sand filters, phosphorus removal, and chlorination. However, due to the high natural quality of the Olentangy Rivers, EPA concluded that the residual chlorine concentrations that would be released into the river would be extremely hazardous to the river's quality. The Olentangy River is a State Scenic River with good dissolved oxygen levels, a high diversity of aquatic insects, a variety of mollusks including four state endangered species, a wide biological diversity, and is one of the few remaining natural stream segments in central Ohio. Alternative disinfection agents considered were ozone, sulfur dioxide effluent dechlorination, bromine chlorine, and ultraviolet light. Ozone was selected because it is produced on site and does not have to be stored, it has been used for several years in drinking water with no observed toxic effects, and it does not increase instream levels of dissolved solids. While ozonation was more costly than chlorination in terms of monetary investment, it was less costly in terms of social and ecological factors. Text of a brief discussion on the paper is included. (See also W80-02812) (Seigler, IPA)
W80-02831

BIOLOGICAL TREATMENT OF FOOD PROCESSING WASTEWATER DESIGN AND OPERATIONS MANUAL.
Stanley Associates Engineering Ltd., Ottawa (Ontario).
Available from the Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada, K1A 1C8. Economic and Technical Review Report EPS 3-WP-79-7, October 1979, 216 p, 55 Fig, 41 Tab, 30 Ref, 2 App.

Descriptors: *Biological treatment, *Food processing industry, *Waste water treatment, Organic wastes, Aeration, Treatment facilities, Ponds, Lagoons, Filters, Activated sludge, Manuals, Design, Operations, Permits, Administrative agencies.

Recent environmental legislation has made it necessary, in many cases, for the food industry to treat its wastewater prior to discharge. Although most wastes from the food processing industry are amenable to biological treatment, the success of the operation has been hindered by seasonability of operation, climatic conditions, faulty design and inadequate operation, as well as poor in-plant controls. This manual presents information regarding the design and operational requirements of currently available technology. The manual is intended to provide useful information to the food processing industry in assessing its treatment needs. Twelve case histories are presented for plants processing fruits and vegetable, milk products, meat products, and beverages. Design and operational data for existing wastewater treatment systems are included in the case histories. (WATDOC)
W80-02837

TOXICITY OF EFFLUENTS FROM SULPHITE PULPING OPERATIONS PRACTICING RECOVERY AND BIOLOGICAL TREATMENT.
Beak Consultants Ltd., Mississauga (Ontario).
Available from Environmental Protection Service, Department of the Environment, Ottawa, Ontario, Canada, K1A 1C8. Economic and Technical Review Report EPS 3-WP-79-9, October 1979. 51 p, 18 Tab, 34 Ref.

Descriptors: *Effluents, *Biological treatment, *Sulfite liquors, *Pulp and paper industry, Pulp wastes, Waste water treatment, Rainbow trout, United States, Canada, Fishkill, Toxicity, Recovery systems, Treatment practices

This study was conducted to determine whether conventional secondary biological treatment detoxifies sulphite pulp mill effluents. Seven sulphite pulp mills, varying in pulping base, wood species, type of treatment and recovery system and geographical location were studied. All mills were located in the United States and practiced some form of chemical recovery and biological treatment (aerated lagoons or activated sludge). Samples of mill effluents before and after biological treatment were collected four times over six months. Standard 96-hour static bioassays using rainbow trout (Salmo gairdneri) determined the LC50 value of each sample. Acute lethality was defined by a compliance standard of LC50 =

100%. Other routine analyses such as pH, biochemical and chemical oxygen demand, ammonia and total suspended solids were also conducted. Results of the study showed that all untreated effluents were acutely lethal and indicated that, in the majority of cases, biological treatment was capable of detoxifying the effluents. (WATDOC)
W80-02840

NITRIFICATION-DENITRIFICATION OF WASTEWATER USING A SINGLE-SLUDGE SYSTEM, VOLUME II,
Ontario Ministry of the Environment, Toronto. Wastewater Treatment Section.
A. G. Smith.
Available from Training and Technology Transfer Division (Water), Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada, K1A 1C8. Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No 96, 1979, 67 p, 22 Fig, 13 Tab, 16 Ref, 21-1-20.

Descriptors: *Ferric chloride, *Inorganic carbon, *Phosphorus removal, *Nitrogen removal, Analytical data, Effluents, Biology, Ammonia, Sampling, Kleinberg, Ontario.

This report describes a full-scale evaluation of the split-return mode for nitrification-denitrification of a combined domestic/industrial wastewater. The investigation, which took place from July 1974 to December 1975 at the Ontario Ministry of the Environment's Ontario Experimental Facility at Brampton, followed pilot-studies at Kleinburg, Ontario. The evaluation investigated the effect of ferric chloride addition on phosphorous removal; the effect of solids retention times and sludge ages on nitrogen reactions at various temperatures; hydrogen peroxide addition and the use of a screen centrifuge on mixed liquor conditioning; as well as the suitability of the system for solids control and for maintenance of consistent nitrogen removal under different temperature conditions. It was concluded that the single-sludge, split-return system gave excellent nitrogen removal with minimal methanol application. Control of solids in both aeration and denitrification basins was easily accomplished by adjusting the return-split. On-site monitoring of the process was also easily accomplished. The lack of a clearly defined temperature effect on nitrogen metabolism was attributed to the long sludge retention time inherent in the system. (See also W79-07225) (WATDOC)
W80-02841

ADVANCED WASTEWATER TREATMENT TECHNOLOGY IN CANADA (1979),
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
J. W. Schmidt.
Available from Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada KLA 1C8. Economic and Technical Review Report EPS 4-WP-79-5, August 1979, 57 p, 13 Fig, 21 Tab, 42 Ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Municipal water, *Phosphorus, *Nitrogen, *Filtration, *Biochemical oxygen demand, Suspended solids, Ozone, Reverse osmosis, Treatment facilities, Technology, Feasibility studies, Basins, Great Lakes, British Columbia, Ontario, Saskatchewan.

Information is presented on the use of Advanced Wastewater Treatment (AWT) technology in Canada for the treatment of municipal wastewaters. AWT in the Canadian context is defined, specific requirements for the application of AWT are identified, and examples of the systems in use are described. In addition, Canadian pilot scale research and development efforts of recent years are discussed. Specific applications dealt with are the use of AWT for phosphorus removal, nitrogen conversion and removal, post filtration for BOD5 and suspended solids removal, studies on the use of ozone, reverse osmosis and the physical-chemical treatment of municipal wastewaters. In Canada, different approaches to AWT have been taken to resolve specific problems. The principal applications are physical-chemical treatment for phosphorus removal at over 140 mechanical plants, mainly in the Province of Ontario. The most popular method for phosphorus removal is accomplished by 'in plant' modifications to existing treatment systems. Effluent filtration to meet more stringent BOD5 and SS effluent criteria is practiced at a limited number of Canadian plants. (WATDOC)
W80-02842

WATER MOVEMENT IN A LAND TREATMENT SYSTEM OF WASTEWATER BY OVERLAND FLOW,
Army Terrestrial Sciences Center, Hanover, NH. Applied Research Branch.
For primary bibliographic entry see Field 2G.
W80-02853

THE MERRIMACK: DESIGNS FOR A CLEAN RIVER. ANNEX C: CONSULTANT'S INDUSTRIAL WASTEWATER PROFILES.
Weston (Roy F.) Inc., Boston, MA.
For primary bibliographic entry see Field 5E.
W80-02876

EFFECT OF PARTICULATES ON DISINFECTION OF ENTEROVIRUSES IN WATER BY CHLORINE DIOXIDE,
Cincinnati Univ., OH. Dept. of Civil Engineering.
P. V. Scarpino, F. A. O. Brigano, S. Cronier, and M. L. Zink.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-108301, Price codes: A04 in paper copy, A01 in microfiche. Report No EPA-600/2-79-054, July 1979, 67 p, 22 Fig, 9 Tab, R-804418.

Descriptors: *Disinfection, *Chlorine, *Particle size, *Viruses, *Turbidity, Water pollution sources, Chlorination, Enteric bacteria, E. coli, Sewage bacteria, Microorganisms, Potable water, Water purification, Water supply, Chlorine dioxide.

The use of chlorine dioxide as a waste water disinfectant was examined in laboratory studies using the organisms poliovirus 1, coxsackievirus A9, and Escherichia coli. Chlorine dioxide is being considered as a disinfectant for drinking water due to its reduced formation of carcinogenic compounds when compared to chlorine. Experiments were conducted to determine the effects of particulates, temperature, contact times, pH values, and viral aggregation on the disinfectant levels produced by chlorine dioxide. The two viruses tested were significantly more resistant to chlorine dioxide disinfection than the bacterial organism, e. coli. Viral aggregation was found to effect disinfection rates. Cell-associated polioviruses showed no greater resistance than unassociated polioviruses probably due to the existence of the associated poliovirus in a non-aggregate state. An inverse correlation was found between bentonite protection of poliovirus disinfection and rising turbidity and temperature. As bentonite turbidity and temperature increase, disinfection decreases for bentonite-adsorbed poliovirus. Overall at the pH of most drinking waters chlorine dioxide was found to be an excellent disinfectant. (Seigler-IPA)
W80-02998

5E. Ultimate Disposal Of Wastes

EFFECTS OF FLUE GAS CLEANING WASTE ON GROUNDWATER QUALITY AND SOIL CHARACTERISTICS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118656, Price codes: A07 in paper copy, A01 in microfiche. Report No EPA-600/2-79-164, August 1979. 128 p, 23 Fig, 64 Tab, 26 Ref, 3 Append.

Descriptors: *Sludge disposal, *Leaching, *Stabilization, *Lagoons, Groundwater, Aquifers, Hydrogeology, Path of pollutants, Soil contamination, Water pollution, Calcium, Boron, Water sampling, Permeability, Sulfur compounds.

Three unlined, unstabilized power plant waste disposal ponds containing flue gas cleaning (FGC) sludges located in different geological circumstances were studied to assess the extent of pollutant migration into the local groundwater and the effects on surrounding soils. Examination of the three geological settings identified two major types, one site was underlain by impermeable materials (clay and shale) and two of the sites were underlain by relatively permeable silty sands and gravel with finer materials discontinuously distributed throughout. A probable pattern of leachate movement and attenuation was used to identify the locations for borings for water and soil sampling. Results indicate that: (1) FGC sludge/ash ponds are not self-sealing, (2) at all three sites FGC sludge/ash-related materials had moved into surrounding soils and groundwater, and (3) soils below the ponds do not permanently retain any of the pollutants except calcium and boron. The site with impermeable substrata showed no permeability change related to the pond.At one of the sites with permeable substrata changes in permeability, dry density, water content, and percent fines were related to the pond. Overall FGC sludge/ash disposal sites can pollute groundwaters and are a threat to drinking water aquifers. Planning for FGC sludge/ash disposal areas should include a groundwater monitoring program. (Seigler-IPA)
W80-02726

THE MERRIMACK: DESIGNS FOR A CLEAN RIVER. ANNEX C: CONSULTANT'S INDUSTRIAL WASTEWATER PROFILES.
Weston (Roy F.) Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 682, Price codes: A09 in paper copy, A01 in microfiche. Prepared for U.S. Army Corps of Engineers, New England Division, August 1974. 174 p.

Descriptors: *Waste water treatment, *Industrial wastes, *Chemical wastes, *Waste water(Pollution), *Textiles, *Plastics, *Pulp and paper industry, *Tannery wastes, *Effluents, *Water pollution, *Water pollution sources, *Merrimack River(MA), *Metal plating wastes, Waste water disposal, Liquid wastes, Bleaching wastes, Cotton, Fabrics, Fibers(Plant), Polymers, Resins, Pulp wastes, Cellulose.

Annex C is a compendium of five reports. The first is an assessment of some significant wastewater disposal aspects of the plastics industry. Particular attention is paid to how this industry will affect a wastewater management program for the Merrimack River Basin. Studied are manufacturing processes and wastewater characteristics, sources and loading associated with polymer production. Brief discussions and data relative to specific polymers and resins are presented. Treatment systems are suggested and costs analyzed. The second report is an industrial wastes profile of metal plating wastes in the basin. A typology is presented. The effects of these wastes on sewers, treatment plant processes, receiving wastes and water supplies is reviewed. Conventional treatment practices are outlined and current developments in metal plating waste treatment evaluated. The third report surveys the waste problems of the textile industry. It reviews the causes of pollution in the industry and then studies effluents from specific types of cloth and textile plants. Plants include those dealing with cotton and cotton blends, wool, synthetics and nonwoven fabrics. Report four studies the nature and treatment of tannery effluents. Both upper side leather manufacturing and sheepskin suede leather manufacturing processes are discussed and particular effluents from each stage of manufacturing are identified. The last report outlines paper effluents. Each step of the papermaking process and the resulting effluent are studied. Pretreatment and primary, secondary and tertiary treatments are evaluated. (Zayac-NC)
W80-02876

5F. Water Treatment and Quality Alteration

OZONE AND ULTRAVIOLET RADIATION DISINFECTION FOR SMALL COMMUNITY WATER SYSTEMS,
Vermont State Dept. of Health, Burlington.
L. E. Witherell, R. L. Solomon, and K. M. Stone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-108418, Price codes: A03 in paper copy, A01 in microfiche. Report No EPA-600/2-79-060, July 1979. 46 p, 5 Fig, 15 Tab, 41 Ref. 68-03-2182

Descriptors: *Disinfection, *Ozone, *Ultraviolet radiation, *Chlorination, Water treatment, Water purification, Operating and maintenance, Aquatic bacteria, Coliforms, Water sampling, Vermont, Water distribution(Applied), Water quality, Water storage.

Ozone and ultraviolet radiation were compared to chlorination as disinfectants for small water systems. Due to inadequately trained operators and poor maintenance, the use of chlorination in small community water systems often results in inadequate disinfection. Areas compared included disinfection capability, operation and maintenance requirements, and costs. Five existing small water systems in Grand Isle County, Vermont, were used for the comparison. Ultraviolet radiation disinfection units were installed at two sites, ozone disinfection units at two sites, and the fifth system was unchanged from its unfiltered chlorination system. Data were collected for 3 to 21 months. Results show that both ozone and ultraviolet radiation are inferior to chlorination in the areas of operation, maintenance requirements, and the retention of disinfection levels in water distribution systems. It was also found that even in small water systems a disinfectant residual such as that provided by chlorination but not by ozonation or ultraviolet radiation is needed to maintain proper disinfection in distribution systems. (Seigler-IPA)
W80-02725

THE EFFECTS OF CALCIUM, ALUM AND PH ON THE REMOVAL OF NATURALLY OCCURRING MANGANESE BY RAPID SAND FILTRATION,
Auburn Univ., AL. Dept. of Civil Engineering.
M. J. Keal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-135148, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, December 13, 1979. 66 p, 15 Fig, 21 Ref. OWRT A-064-ALA (1).

Descriptors: *Manganese, *Sands, *Filtration, *Water treatment, Aluminum, Lime, Calcium compounds, Domestic water, Water quality, Water types, Flocculation, Chemical precipitation, Water purification, Water quality standards, Alabama.

Water samples from Lake Saugahatchee, the water supply for Opelika, Alabama, were used in tests to determine the effects of chemical additive on manganese removal by sand filtration. Varying concentrations of calcium nitrate were added to samples of natural water containing oxidized manganese. The samples were run through a sand filter and the amount of manganese not removed was measured. The most effective calcium concentration gave a manganese removal rate of 70%. This concentration was then tested with varying pH conditions. Samples were also run with additions of alum, and aluminum sulfate, at various pH levels. Finally, tests were run with calcium added as lime. Results show: (1) sand filtration alone removes little manganese; (2) calcium addition does improve manganese removal; (3) increased pH has a positive effect on manganese removal when calcium is added; and (4) alum addition improves manganese removal. Contributions of alum and calcium additions were also found to increase manganese removal. Application of study results should be valuable in southern treatment systems where high manganese and low calcium concentrations naturally exist. (Seigler-IPA)
W80-02767

LAKE RESTORATION BY NUTRIENT INACTIVATION,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
W. H. Funk, and H. L. Gibbons.
In: Lake Restoration, Report No EPA 440/5-79-001, p 141-151, 1979. 15 Fig, 10 Tab, 31 Ref.

Descriptors: *Eutrophication, *Nutrients, *Chemical precipitation, Water treatment, Chemical reactions, Phosphorus, Aluminum, Algal control, Aquatic algae, Lakes, Lake stages, Chlorophyll, Dissolved oxygen, Water pollution treatment.

Nutrient inactivation is accomplished by the addition of a chemical precipitant such as aluminum, iron, or calcium to polluted water. The nutrients in the polluted water bond with the precipitant and become unavailable for nuisance algal and plant growth. While nutrient inactivation has been a common wastewater treatment technique, it has only recently been used to any appreciable extent for lake restoration. Aluminum is the most widely used lake nutrient inactivant. Nutrient inactivation projects and results are discussed for Horseshoe Lake in Wisconsin, Twin and Dollar Lakes in Ohio, Medical and Liberty Lakes in Washington, and Cline's Pond in Oregon. In most nutrient inactivation projects there is an immediate reduction of available phosphorus. Nutrient inactivation is relatively inexpensive when compared to many algicides, however, costs rapidly increase for the treatment of large lakes. Care must be taken to determine and to add the correct amount of inactivant since too much inactivant causes a drop in pH organisms and fish. Nutrient inactivation has a 2-3 year effective period and therefore is not a long term solution to eutrophication problems. (See also W80-02773) (Seigler-IPA)
W80-02796

5G. Water Quality Control

COMPUTER-AIDED STREAM POLLUTION CONTROL AND MANAGEMENT, PART I,
New York State Dept. of Environmental Conservation, White Plains.
M. H. Wang, L. K. Wang, J. F. Kao, C. G. Wen, and D. Vielkind.
Journal of Environmental Management, Vol 9, p 165-183, 1979. 3 Tab, 2 Fig, 13 Ref.

Descriptors: *Environmental management, *Planning, *Stream pollution control, Dissolved oxygen, Biochemical oxygen demand, Multiple linear correlation method, Mathematical models, Computer program.

A comparison between the Streeter-Phelps method and the Churchill and Buckingham method is made for the computation of dissolved oxygen deficit and organic waste loads on a receiving stream. Principles of multiple linear correlation are described. Normal equations, standard error equation and correlation coefficient equation are derived. Two mathematical models involving the multiple linear correlation of four critical parameters (dissolved oxygen, biochemical oxygen demand, water temperature and river flow) near a point source of pollution are derived with a FORTRAN computer program. (See also W80-02702)
W80-02701

COMPUTER-AIDED STREAM POLLUTION CONTROL AND MANAGEMENT, PART II,
Stevens Inst. of Tech., Hoboken, NJ.
L. K. Wang, M. H. Wang, J. F. Kao, and C. G. Wen.
Journal of Environmental Management, Vol 9, p 185-204, 1979. 1 Fig, 2 Tab, 11 Ref.

Descriptors: *Environmental management, *Planning, *Stream pollution control, Dissolved oxygen, Biochemical oxygen demand, Multiple linear correlation method, Mathematical models, Computer program.

The dissolved oxygen drop is a function of the combined biochemical oxygen demand loads of upstream, the temperature of stream water and the stream flow. A mathematical model which adequately expresses this function can be developed by means of the multiple linear correlation method. This paper describes the methods and the procedures used for mathematical modelling. Practical examples are presented and discussed. (See also W80-02701)
W80-02702

INTERNATIONAL WATER USE RELATIONS ALONG THE SONORAN DESERT BORDERLANDS,
Arizona Univ., Tucson. Office of Arid Lands Studies.
M. H. Jamail, and S. J. Ullery.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134976, Price codes: A08 in paper copy, A01 in microfiche. Arid Lands Resource Information Paper No 14, 1979. 146 p, 8 Fig, 1 Tab, 355 Ref. OWRT-C-90004-W (9604)(1), 14-34-0001-9604.

Descriptors: *International waters, *International Bound and Water Comm, *Water pollution sources, *Colorado River, *Mexico, *Governmental interrelations, Mexican Water Treaty, Colorado River Basin, Arizona, California, International Commission, Water quality, Legal aspects, Documentation, Bibliographies.

Water resources in the arid-semiarid region of the Sonoran Desert Borderlands are, and historically have been, difficult to manage due to the artificial political boundary between Mexico and the United States. The current state of water use relations in this area are examined from published and unpublished articles and manuscripts, government reports and hearings, press reports, first-hand observations, and interview with officials and other involved individuals. Water resources areas examined include international groundwater, surface water, and water pollution. The International Boundary and Water Commission (IBWC) is designed to deal with these issues, however, rapid urbanization along the border with its accompanying municipal and industrial water demands has created new conflict areas other than the long-standing conflict over agricultural water use. IBWC has a limited scope of authority and is inadequate in resolving issues where sound water management is secondary to political considerations. President Carter and President Lopez Portillo have made a commitment to solve the increasing pollution problems. Study documentation is presented including a bibliography with keyword and author indexing, supplementary references, press reports, file references, interviews, maps, and photographs. (Seigler-IPA)
W80-02766

A SIMPLE POLLUTION VULNERABILITY INDEX FOR PRELIMINARY COASTAL WATER QUALITY MANAGEMENT PLANNING,
Maine Univ. at Orono. Land and Water Resources Center.
B. J. Edwards, and F. E. Woodard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134323, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, October 1979. 29 p, 6 Fig, 2 Tab, 34 Ref, 1 Append. OWRT A-047-ME (1).

Descriptors: *Coasts, *Water pollution control, *Water quality control, *Maine, Mathematical models, Sea water, Industrial wastes, Aquatic life, Coliforms, Water pollution sources, Shellfish, Pollutants, Path of pollutants, Vulnerability, Water management(Applied).

A quantitative pollution vulnerability index was developed for locating future coastal discharge in Maine so that deleterious effects are minimized. The index is designed to serve as a planning tool for agencies in coastal zone management. The vulnerability of a coastal zone is determined by its capacity to accept a particular pollutant which is a function of dispersion, background pollutant levels, and allowable limits. The intended use of an area of water determines the maximum allowed concentration. In many cases this intended or designated

use is defined in the Maine State Coastal Classification System. Data on background pollutant levels was obtained from the State of Maine Sea and Shore Fisheries, the Department of Environmental Protection, and other private sources. In most cases the data are site-specific and estimates must be used until more detailed data are available. The Weyl 'pollution susceptibility index' is used because it is mathematically simple and requires minimal input data. Because levels of critical use are not well defined for a wide range of pollutants, fecal coliform is used for an example. Study conclusions are: (1) vulnerability can be expressed numerically to compare one area to another for a particular pollutant, (2) allowable limits for different pollutants with respect to various marine organisms needs to be determined, (3) data on pollutant background levels is currently insufficient, and (4) vulnerability index use is limited due to a lack of 'use-allowable limit' relationships for pollutants. (Seigler-IPA)
W80-02768

SEPARATION OF OIL FROM WATER,
Dow Chemical Co., Midland, MI. (Assignee).
R. H. Hall, D. H. Haigh, and E. G. Larson.
U.S. Patent No 4,172,031, 6 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 952, October 23, 1979.

Descriptors: *Patents, *Oil pollution, *Water quality control, Oily water, Separation techniques, Adsorption, Resins, Equipment, Oleophilic properties.

Water containing traces of oil is cleaned by passing through a porous bed containing oleophilic bodies and oil imbibing bodies. Oil is collected on the surface of the oleophilic bodies and removed from the oleophilic bodies by the oil imbibing bodies. Such beds have a high capacity for oil retention while maintaining separating efficiency. The apparatus comprises means defining a stream receiving channel and a first sorption bed transverse in the channel. The first sorption bed is permeable to water and in sealing engagement with the channel so that water flowing within the channel must flow through the bed. The bed comprises a first oleophilic surface and at least one organic liquid swellable synthetic resinous body in contact with the oleophilic surface. (Sinha - OEIS)
W80-02771

SECONDARY SALINIZATION AND SODICATION IN EGYPT: A CASE STUDY,
Alexandria Univ. (Egypt).
M. M. El-Gabaly.
Water Supply and Management, Vol 3, No 3, p 179-199, 1979. 26 Ref.

Descriptors: *Egypt, *Salinity, *Soils, *Secondary salinization, *Sodication, *Alkaline soils, Saline soils, *Soil management, Soil analysis, Land reclamation, Soil investigations, Agriculture, Agricultural practices, Irrigation, Leaching, Land management, Land, Saline water, Pollution(soils), Impoundments.

The study assesses the land resources affected by secondary salinization and sodication in Egypt. Secondary salinization is the result of man's failure to control the salt regime of the soil; the rate and extent varies according to natural factors such as landscape, ground water hydrology, and geochemistry. Salinization and sodication are linked geomorphologically to low lands such as the northern part of the Nile Delta. Soil and agronomic practices inducive to secondary salinization under Egyptian conditions include poor levelling, fallowing, cropping pattern, insufficient leaching and formation of a plowsol layer resulting from repeated tillage at a given depth. Reclamation techniques and measures for controlling secondary salinization include drainage, soil improvements, leaching, addition of gypsum, control of seepage, on-farm water use and soil and agronomic practices. Studies for both prognosis and monitoring of salinity and sodicity include soil and hydrological surveys, field and laboratory measurements, satellite imagery and crop performance. A successful reclamation program should accomplish reduction of salt content in root zones, lowering of water table below the critical level, desalination of ground water, and prevention of resalinization of soil. Specific management practices are suggested to accomplish this. (Iervolino-NC)
W80-02858

PERFORMANCE OF AN AXIAL FLOW PUMP FOR LAKE DESTRATIFICATION,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2H.
W80-02879

IRRIGATION MANAGEMENT FOR RIVER-SALINITY CONTROL,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
J. P. Riley, and J. J. Jurinak.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR4, Proceedings Paper 15023, p 419-432, December 1979. 3 Fig, 2 Tab, 9 Ref, 2 Append.

Descriptors: *Salinity, *Rivers, *Irrigation, *Irrigation effects, *Colorado River, Data collections, Return flow, Irrigation practices, Salts, Water quality, Water quality control, Management(Applied), Model studies, Mathematical models, Simulation analysis, River systems, Agriculture, Farm management.

The salinity of a given river system is the result of both salt-concentrating and salt-loading effects. Concentrating effects are produced by evaporation, diversion of high-quality water from the basin, and consumptive use by natural vegetation and by irrigated crops. The salt loading effects occur through dissolving action in the soil and the underlying materials. The water for this latter process originates from both irrigation applications and from precipitation that infiltrates into the soil matrix. Because a significant contribution to the total salt load of the upper Colorado River system originates from irrigation return flows, a procedure is needed that will predict the effects of irrigation management on salt inputs to the river. The paper presented the concepts and input data used in developing a one-dimensional streamflow and salt mass-balance model for long-run average effects of irrigation efficiency on salinity. (Sims-ISWS)
W80-02908

MANAGING STORM RUNOFF IN CHICAGO AREA,
Metropolitan Sanitary District of Greater Chicago, IL.
B. T. Lynam, F. C. Neil, and F. E. Dalton.
Journal of the Technical Councils of ASCE, American Society of Civil Engineers, Vol 105, No TC2, Proceedings Paper 15035, p 401-413, December 1979. 5 Fig, 7 Ref.

Descriptors: *Flood control, *Illinois, *Water quality control, *Drainage, *Cities, *Planning, Storage, Underground storage, Reservoir storage, Runoff, Storm runoff, Urban runoff, Tunneling, Tunnels, Water quality, Hydrology, Sanitary engineering, *Chicago(IL).

Existing combined sewers in the Chicago area discharge a mixture of storm water runoff and sewage to the rivers about 100 times/year and on occasions overload the river system making it necessary to reverse the flow of the river system into Lake Michigan. Storm water and drainage in the combined sewer area will be managed by a system of tunnels and reservoirs under construction. In the separate sewered area, a system of reservoirs, channel improvements, and land treatment is being implemented; and, to reduce the erosion and siltation problems of the rivers and streams, on-site detention in new residential and industrial developments is being required. Thus, the goals of Chicago's Areawide Wastewater Management Program are comprehensive, including simultaneous flood control and water quality improvements. (Sims-ISWS)
W80-02914

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

STORM DRAINAGE PIPES -- HOW BIG SHOULD THEY BE,
Working Party on the Hydraulic Design of Storm Sewers (England).
P. Colyer.
Water, No 28, p 57-59, September 1979. 2 Fig, 2 Ref.

Descriptors: *Storm drains, *Storm runoff, *Urban drainage, Drainage systems, Urban hydrology, Pipes, Combined sewers, Overland flow, Hydrographs, Precipitation(Atmospheric), Computer models, Computer programs, Model studies, Rainfall-runoff relationships, Rainfall intensity.

The United Kingdom's Working Party on the Hydraulic Design of Storm Sewers is developing a computerized economic methodology for use by engineers in the design of storm drainage systems. Major areas of concern in storm sewer design are rainfall, overland flow, pipe flow and sewer ancillaries, and costs and economics. Because rainfall durations and intensities vary the computer programs are designed to use four rainfall durations. The programs can also simulate drainage system behavior under various observed rainfall conditions. Catchment characteristics were used to calculate the necessary equations for modelling overland flow characteristics. The Muskingum-Cunge routing technique is used for most applications concerning pipe flow. Storm overflows, on-line and off-line tanks, and pumping stations can currently be simulated by the system. The program also has provisions for costs and economic evaluations. Because the program is modular it can be modified to fit assorted user needs. Uses include the analysis of existing storm sewer systems as well as the design of new systems. System methods available include: a modified Rational method; a general hydrogrpah method; a design method for pipe depths, gradients, and diameters; and a performance calculating method. The system is currently being tested by three methods and programs and manuals should be available late in 1980. (Seigler - IPA)
W80-02758

ENVIRONMENTAL QUALITY AND RESIDUALS MANAGEMENT,
Resources for the Future, Washington, DC.
For primary bibliographic entry see Field 6B.
W80-02846

MODELS FOR WATER RESOURCES DECISION-MAKING: PROBLEMS AND PROJECTS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
A. K. Biswas.
Water Supply and Management, Vol 3, No 1, p 1-7, 1979.

Descriptors: *Decision making, *Mathematical models, *Methodology, *Computer models, *Model studies, *Water resources, Statistical models, Mathematical studies, Administration, Alternate planning, Analytical techniques, Water resources planning, Management.

The modeling approach to water resources management is claimed to be primarily an academic exercise that is seldom used to solve real life problems. The first and foremost reason for this 'credibility gap' is that the proponents of mathematical modeling and computer technology generally have done a poor job of translating outputs into terms that are readily understandable to those not so intimately involved in the art. In addition to the bulky volumes of data, the results of modeling efforts are seldom presented in simple, straightforward, and meaningful ways. Another reason for the development of the credibility gap is the lack of user involvement in the development process. Another problem is the myth that the problem is too costly and time consuming. Remedies to these

problems must begin with the modelers showing that this mode of analysis not only has tremendous potential for problem analysis but that it can actually be used today to make decisions rationally and effectively. Communication can be improved through the following ways: (1) define concisely the decision maker's problem and information requirements; (2) conduct 'hands-on' workshops using simple but practical examples of how decision capability can be enhanced by considering a host of different alternatives within the modeling process; (3) illustrate some real cases in straightforward and understandable terms, and (4) develop improved methods for displaying mode results or results of model applications. (Iervolino-NC)
W80-02860

MATHEMATICAL PROGRAMMING MODELS APPLIED TO WATER RESOURCES PLANNING,
Tottori Univ. (Japan). Dept. of Civil Engineering.
N. Okada, and K. Yoshikawa.
Water Supply and Management, Vol 3, No 3, p 205-223, 1979. 14 Ref, 12 Fig, 5 Tab.

Descriptors: *Mathematical models, *Mathematical studies, *Programming, *Model studies, *Analytical techniques, *Kakogawa River Basin(Japan), *Hyogo prefecture(Japan), *Decision making, *Goal programming, *Water resources, Linear programming, Mathematics, Cost-benefit ratio, Cost allocation, Multiple objectives planning, Cost analysis, Planning, Management, River basins.

The purpose of this paper is to illuminate the potential and limitations of mathematical methodology as applied to structured information for use of planners and decision makers in deciding on water development systems under limited resources availability. Three kinds of water resources allocation problems are discussed: (1) cost minimization, (2) cost allocation, and (3) multiple objectives. The model for (1) deals with developing a single-(intra-) basin water resources system and consists of one objective function which accounts for total costs and 30 constraints associated with the mass balance condition of water quantity and the prescribed condition for water quality regulation. The model is a nonlinear program with the specific characteristic that a greater part of the constraints are linear. For the cost allocation problem the process is initiated by completion of an inventory of total costs for a set of possible coalitions with the aid of a nonlinear programming model. In terms of the n-person cooperative game, the problem of allocating the total cost among members of a given coalition is formulated as the determination of payoff vector (Xi) which represents a set of assigned portions of the cost to player i (i=1,...,n). For the final problem a mathematical methodology by use of goal programming (an extension of linear programming) is used which specifies two levels for each objective--the permissible and the satisfactory. Case studies were applied in the Kakogawa River basin and the southern part of the Hyogo Prefecture, Japan. Use of these models provides planners and decision makers with a manageable set of promising alternatives for water resource planning. (Iervolino-NC)
W80-02863

AN OVERVIEW OF RIVER-BASIN ASSESSMENT TECHNIQUES IN AN ENERGY-IMPACTED REGION--YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO.
T. D. Steele.
Water Supply and Management, Vol 3, No 3, p 151-171, 1979. 10 Fig, 2 Tab, 29 Ref.

Descriptors: *Water resources, *River basins, *Energy, *Yampa River Basin, *Colorado, *Wyoming, *Energy Resource Development, *Water Resources Development, *Water demand, Assessments, Model studies, Ambient stream quality, Sediment, Reservoirs, Analysis, Groundwater, Remote sensing, Air quality, Decision-making, Management, Impacts, Coal, Modeling studies.

With increasing development of coal production, there is concern over increased water demand and anticipated environmental impacts associated with coal mining, particularly in the Rocky Mountain States which have small populations and limited water resources. These assessment studies focus on the Yampa River basin in northwestern Colorado and south-central Wyoming, and involve that part of the basin east of Dinosaur National Monument. Objectives include: (1) to evaluate the environmental and economic impacts of regional energy- and water-resource development for existing and feasible alternative policies, and (2) to describe the assessment methodologies used so that they may be applied to other energy-rich regions of the western U.S. where water resources are limited. The major energy resource in the basin consists of near-surface coal deposits; other resources--oil and gas, oil shale, uranium and geothermal springs--also occur in the basin. The regional-appraisal and modeling studies used in this assessment are: ambient stream quality, stream traveltime and re-aeration characteristics, waste-load assimilative capacity, sediment loadings in streams, reservoir-modeling analysis, groundwater solute transport, remote-sensing applications and air quality modeling. In this assessment concern was given to projected increased water uses and how they are to be met within existing use patterns and other institutional constraints. Continuing studies such as these will enable resource managers to anticipate potential problems concerning the impending coal-resource development in the Yampa River basin. (Iervolino-NC)
W80-02865

STATE-OF-THE-ART OF GROUNDWATER MODELING,
Camp, Dresser, and McKee, Inc., Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 2F
W80-02866

PRECONSTRUCTION AND POSTCONSTRUCTION GROUND-WATER LEVELS, LOCK AND DAM 4, RED RIVER VALLEY, LOUISIANA,
Geological Survey, Little Rock, AR. Water Resources Div
A. H. Ludwig, and J. E. Reed
Geological Survey open-file report 79-921, June 1979. 22 p, 7 Ref, 6 Plates, 3 Tab, 14 Ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Potentiometric level, *Pre-impoundment, *Post-impoundment, Navigation, Rivers, Locks, Dams, Effects, Groundwater, Water levels, Aquifer characteristics, Alluvial aquifers, Groundwater recharge, Water table, Flood plains, Louisiana, *Red River(LA), Red River Valley(LA), Lock and dam 4.

Proposed construction of a series of locks and dams in the Red River in Louisiana will cause a permanent increase in average river stage. The potentiometric surface of the shallow alluvial aquifer and the water table in the fine-grained material confining the aquifer will be affected. The purpose of this study, using digital-modeling techniques, was to predict the average postconstruction potentiometric surface (steady state) and the water table (nonsteady state) so that potential effects of the water-level changes could be evaluated. Plans for lock and dam 4 at realined mile 154 (kilometer 250) above the mouth of the Red River call for a pool elevation of 115 feet (35 meters) and will cause an average increase in river stage ranging from 24 to 4.5 feet (7 to 1.4 meters). As a result, ground-water levels will be raised 1 foot (0.3 meter) or more between the Red River and Bayou Pierre from the dam to Coushatta, and below Campti, east of the river. The potentiometric surface may be at or near land surface in low areas between the Red River and Bayou Pierre, and above land surface locally upstream from the dam. The magnitude of ground-water-level fluctuations near the river will be reduced to less than half the present range. (Woodard-USGS)
W80-02919

PRECONSTRUCTION AND POSTCONSTRUCTION GROUND-WATER LEVELS, LOCK AND DAM 3, RED RIVER VALLEY, LOUISIANA,
Geological Survey, Little Rock, AR. Water Resources Div.
A. H. Ludwig, and J. E. Terry.
Geological Survey open-file report 79-920, June 1979. 21 p, 7 Fig, 6 Plates, 3 Tab, 11 Ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Potentiometric level, *Pre-impoundment, *Post-impoundment, Navigation, Rivers, Locks, Dams, Effects, Groundwater, Water levels, Aquifer characteristics, Alluvial aquifers, Groundwater recharge, Water table, Flood plains, Louisiana, *Red River(LA), Red River Valley(LA), Lock and dam 3.

Proposed construction of a series of locks and dams in the Red River in Louisiana will cause a permanent increase in average river stage. The potentiometric surface of the shallow alluvial aquifer and the water table in the fine-grained material confining the aquifer will be affected. The purpose of this study, using digital-modeling techniques, was to predict the average postconstruction potentiometric surface (steady state) and the water table (nonsteady state) so that potential effects of the water-level changes could be evaluated. Plans for lock and dam 3 at realined mile 111 (kilometer 179) above the mouth of the Red River call for a pool elevation of 87 feet (27 meters) and will cause an average increase in river stage ranging from 21 to 3.5 feet (1.4 to 1.1 meters). As a result, groundwater levels will be raised to near land surface in low areas east of the river from the damsite to Aloha and in a 0.5-mile (0.8-kilometer) strip along the west side extending 9 miles (14 kilometers) above the dam. The potentiometric surface may be above land surface locally near the dam. The magnitude of ground-water-level fluctuations near the river will be reduced to less than half the preconstruction range. (Woodard-USGS)
W80-02920

PRECONSTRUCTION AND POSTCONSTRUCTION GROUND-WATER LEVELS, LOCK AND DAM 2, RED RIVER VALLEY, LOUISIANA,
Geological Survey, Little Rock, AR. Water Resources Div.
A. H. Ludwig.
Geological Survey open-file report 79-919, June 1979. 18 p, 8 Fig, 4 Plates, 10 Ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Potentiometric level, *Pre-impoundment, *Post-impoundment, Navigation, Rivers, Locks, Dams, Effects, Groundwater, Water levels, Aquifer characteristics, Alluvial aquifers, Groundwater recharge, Water table, Flood plains, Louisiana, *Red River(LA), Red River Valley(LA), Lock and dam 2.

Proposed construction of a series of locks and dams in the Red River in Louisiana will cause a permanent increase in average river stage. The potentiometric surface of the shallow alluvial aquifer and the water table in the fine-grained material confining the aquifer will be affected. The purpose of this study using digital-modeling techniques, was to predict the average postconstruction potentiometric surface (steady state) and the water table (nonsteady state) so that potential effects of the water-level changes could be evaluated. Plans for lock and dam 2 at mile 87 (kilometer 140) above the mouth of the Red River call for a pool elevation of 58 feet (17.7 meters) and will cause an average increase in river stage of 12.5 feet (3.8 meters). As a result, ground-water levels will be raised 1 foot (0.3 meter) or more within 4 miles (6.4 kilometers) of the river and will be near land surface in low areas. The potentiometric surface may be as much as 1 to 2 feet (0.3 to 0.6 meter) above land surface south of Latanier along Chatlin Lake Canal and south of the Annandale area of Alexandria. The magnitude of ground-water-level fluctuations near the river will be reduced. (Woodard-USGS)
W80-02921

PRECONSTRUCTION AND POSTCONSTRUCTION GROUND-WATER LEVELS, LOCK AND DAM 1, RED RIVER VALLEY, LOUISIANA,
Geological Survey, Little Rock, AR. Water Re-

sources Div.
A. H. Ludwig.
Geological Survey open-file report 79-918, June 1979. 17 p, 8 Fig, 2 Plates, 9 Ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Potentiometric level, *Pre-impoundment, *Post-impoundment, Navigation, Rivers, Locks, Dams, Effects, Groundwater, Water levels, Aquifer characteristics, Alluvial aquifers, Groundwater recharge, Water table, Flood plains, Louisiana, *Red River(LA), Red River Valley(LA), Lock and dam 1.

Proposed construction of a series of locks and dams in the Red River in Louisiana will cause a permanent increase in average river stage. The potentiometric surface of the shallow alluvial aquifer and the water table in the fine-grained material confining the aquifer will be affected. The purpose of this study, using digital-modeling techniques, was to predict the average postconstruction potentiometric surface (steady state) and the water table (nonsteady state) so that potential effects of the water-level changes could be evaluated. Plans for lock and dam 1 at mile 44 (kilometer 71) above the mouth of the Red River call for a pool elevation of 40 feet (12.2 meters) and will cause an average increase in river stage of 9 feet (2.7 meters). As a result, ground-water levels will be raised 1 foot (0.3 meter) or more within 4 miles (6.4 kilometers) of the river. The potentiometric surface may be near land surface in low-lying areas, and above land surface along the course of drainage features near the dam. The magnitude of ground-water-level fluctuations near the river will be reduced. (Woodard-USGS)
W80-02922

PRECONSTRUCTION AND POSTCONSTRUCTION GROUND-WATER LEVELS, LOCK AND DAM 5 AND 6, RED RIVER VALLEY, LOUISIANA,
Geological Survey, Little Rock, AR. Water Resources Div.
A. H. Ludwig, and J. E. Terry.
Geological Survey open-file report 79-922, June 1979. 24 p, 7 Fig, 4 Plates, 3 Tab, 14 Ref.

Descriptors: *Model studies, *Surface-groundwater relationships, *Potentiometric level, *Pre-impoundment, *Post-impoundment, Navigation, Rivers, Locks, Dams, Effects, Groundwater, Water levels, Aquifer characteristics, Alluvial aquifers, Groundwater recharge, Water table, Flood plains, Louisiana, *Red River(LA), Red River Valley(LA), Lock and dam 5 and 6.

Proposed construction of a series of locks and dams in the Red River in Louisiana will cause a permanent increase in average river stage. The potentiometric surface of the shallow alluvial aquifer and the water table in the fine-grained material confining the aquifer will be affected. The purpose of this study, using digital-modeling techniques, was to predict the average postconstruction potentiometric surface (steady state) and the water table (nonsteady state) so that potential effects of the water-level changes could be evaluated. Plans for lock and dam 5 at mile 243 (kilometer 390) above the mouth of the Red River call for a pool elevation of 145 feet (44 meters) and will cause an average increase in river stage of 23 feet (7.0 meters). As a result, ground-water levels in the pool area will be raised to near land surface in much of the area between the river and Bayou Pierre and as much as 2 miles (3.2 kilometers) east of the river from the dam upstream to realined mile 220 (kilometer 350). Areas of Barksdale Air Force Base where levels are now near land surface would be enlarged and extend downstream along Flat River to near Curtis. The potentiometric surface may be above land surface near Howard, Anderson Island, and Dixie Gardens. (Woodard-USGS)
W80-02923

COMPUTER SIMULATION AND GEOHYDROLOGY OF A BASALT AQUIFER SYSTEM IN THE PULLMAN-MOSCOW BASIN, WASHINGTON AND IDAHO,
Geological Survey Tacoma, WA. Water Resources Div.
R. A. Barker.
Washington Department of Ecology Water-Supply Bulletin 48, 1979. 119 p, 40 Fig, 1 Plate, 4 Tab, 78 Ref.

Descriptors: *Water level fluctuations, *Groundwater basins, *Model studies, *Drawdown, *Withdrawal, Water wells, Water supply, Water demand, Projections, Aquifer characteristics, Basalts, Aquifer management, Simulation analysis, Washington, Idaho, *Pullman-Moscow basin(Wash-Idaho).

A digital-computer model, using a finite-difference technique, was developed to simulate hydrologic characteristics of a basalt aquifer system in the Pullman-Moscow basin, Washington and Idaho. The model should benefit water agencies by providing for evaluations of various water-management alternatives involving the distribution of well pumping and artificial recharge. The modeled aquifer system underlies about 88,000 acres in the basin and is mostly in the Columbia River Basalt Group. Water-level decline began in the 1890's and by 1975 water levels had declined nearly 80 feet below those of predevelopment conditions. The decline has resulted from year-to-year increases in pumping and a small amount of natural recharge. Pumpage averaged about 6,600 acre-feet per year during 1971-75. Simulation suggests that vertical leakage from upper aquifers is the most important source of recharge to the modeled aquifer system within the basin; this simulated recharge is about 4,900 acre-feet for 1975. Simulation also indicates that lateral recharge from the southwest to the modeled system increased from zero (under predevelopment conditions) to about 1,450 acre-feet in 1975; lateral discharge from the basin, as simulated, was reduced to less than half the rate of 2,850 acre-feet per year under predevelopment conditions. Simulation to the year 2000, projecting a doubling of present-day pumping rates, indicates water-level decline of 30 to 35 feet below 1975 levels. A projection with pumping stabilized at 6,600 acre-feet per year indicates a decline of less than 10 feet below 1975 levels. (Woodard-USGS)
W80-02935

6B. Evaluation Process

COMPUTER-AIDED STREAM POLLUTION CONTROL AND MANAGEMENT, PART I,
New York State Dept. of Environmental Conservation, White Plains.
For primary bibliographic entry see Field 5G.
W80-02701

COMPUTER-AIDED STREAM POLLUTION CONTROL AND MANAGEMENT, PART II,
Stevens Inst. of Tech., Hoboken, NJ.
For primary bibliographic entry see Field 5G.
W80-02702

SOCIAL IMPACT STUDIES BELTON AND STILLHOUSE HOLLOW RESERVOIRS,
Texas Univ. at Austin. Dept. of Civil Engineering.
S. Chang, and L. R. Beard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-133895, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No CRWR-164, June 1979. 126 p, 30 Fig, 10 Tab, 3 Append. OWRT C-7680 (No 7255)(1).

Descriptors: *Social impact, *Texas, *Reservoirs, Economic impact, Employment, Recreation, Social values, Evaluation, Flood control, Human population, Environmental effects, Beaches, Public health, Transportation, Income, Benefits.

The social effects resulting from the implementation of reservoir water resources projects are examined. As examples, the social impacts resulting from the Belton and Stillhouse Hollow Reservoirs, Bell County, Texas, are documented and used to develop principles for evaluating projects in an integrated manner. Beneficial and adverse social effects are evaluated in the areas of: (1) personal effects, (2) community and institutional effects, (3) regional socio-economic effects, (4) national and emergency preparedness effects, and (5) aggregate social effects. Impact information was gathered from public data such as the U. S. census, from expert informants, and from personal interviews and questionnaires. Questionnaires and results from 11 land owner interviews are presented. Belton Dam, costing $13.8 million, was constructed by the U. S. Army Corps of Engineers beginning in 1949 and completed in 1954. The reservoir has 13.6 miles of shoreline and is 3 by 26 miles in area. Stillhouse dam was begun by the Corps in 1962 and completed in 1968. Its total cost was $20.1 million. The reservoir has 58 miles of shoreline. Overall impact analysis shows that social impacts are only occasionally related directly to economic effects and the most important impacts are those in the areas of health, welfare, and quality of living. Also, most of these impacts could be created in an alternative manner not involving reservoir construction. The quantitative value of social impacts should be limited by the cost of providing these alternative equivalent impacts. (Seigler-IPA)
W80-02710

WESTERN COAL PLANNING ASSISTANCE PROJECT: PHASE I, FINAL REPORT.
Western Coal Planning Assistance Project, Billings, MT.
Missouri River Basin Commission; Resource and Land Investigations Program (USGS), February 1979. 64 p, 4 Fig, 3 Tab, 7 Append.

Descriptors: *Coal mines, *Montana, *North Dakota, *Wyoming, *Future planning(Projected), Forecasting, Long-term planning, Missouri River, Evaluation, Land use, Energy, Environmental effects, Economic impact, Project planning, Comprehensive planning, Data collections.

In September 1977 Phase I of the Western Coal Planning Assistance Project (WCPAP) was begun to assist local planners in the major coal areas of Montana, North Dakota, and Wyoming. WCPAP was conducted by the Missouri River Basin Commission and the U.S. Geological Survey's Resource and Land Investigations Program. Objectives of Phase I of WCPAP were: (1) to determine the technical and information needs for assessment of coal development alternatives, (2) to develop the analytical tools and methods to respond to the various constraints encountered, and (3) to conduct workshops to help planners and decision makers. To meet these objectives WCPAP developed a Planning Reference System for State and local planners. The system consists of four documents: a fact book, a guide to impact assessment methods, a forecasts document, and a source book. Personal interviews, questionnaires, and workshop discussions were used for a planning and needs survey. Survey results are grouped into the following areas: technical assistance, training programs, information exchange, physical data, and social and economic data. The Planning and Reference System will need continual updating and supplementing to prevent it from becoming obsolete. The information in the system should be made available to planners throughout the Missouri River Basin and extensive training must be conducted to demonstrate the use and application of the methodologies and concepts in the system. (Seigler-IPA)
W80-02712

WESTERN COAL PLANNING ASSISTANCE PROJECT: FORECASTS FOR WESTERN COAL/ENERGY DEVELOPMENT.
ABT Associates, Inc., Englewood, CO.
Missouri River Basin Commission; Resource and Land Investigations Program (USGS), January 1979. 145 p, 11 Fig, 14 Tab, 46 Ref.

Descriptors: *Coal mines, *Montana, *North Dakota, *Wyoming, *Future planning(Projected), Long-term planning, Project planning, Projections, Land use, Comprehensive planning, Model studies, Forecasting, Evaluation, Time series analysis, Mathematical models, Sites, Energy.

Existing coal/energy forecasts are explained and compared as a part of the Planning Reference

System for planners and decision makers developed by the Western Coal Planning Assistance Project (WCPAP). WCPAP is designed to aid State and local planners and decision makers in the development of technical methods and information required to cope with coal-energy development problems. The project involves major coal areas in Montana, North Dakota, and Wyoming. A current problem for planners is that although many forecast methods have been developed, most are site-specific, yet vast differences are found from site to site in the WCPAP region. Also, there have been few guidelines for adapting site-specific information to other sites. As a result of these limitations existing coal/energy forecasts are infrequently used. While forecasts will not define the future they can provide a more specific method for anticipating future needs and the priorities that need to be established to meet those needs. Basically the groups of forecast methods include programming models, time series analysis, economic base or input-output related techniques, econometric models, and simulation methods. Existing coal/energy forecasts are evaluated in the areas of: (1) coal production forecasts, (2) study location, (3) data bases used, (4) economic relationship assumptions, (5) time frame, (6) technical change and capital availability assumptions, (7) Federal rules and regulations, and (8) State and local institutional factors. Guidelines are presented for the use of the various methods by planners and decision makers. (Seigler-IPA)
W80-02714

WESTERN COAL PLANNING ASSISTANCE PROJECT: A GUIDE TO METHODS FOR IMPACT ASSESSMENT OF WESTERN COAL/ENERGY DEVELOPMENT.
Mountain West Research, Inc., Billings, MT.
Missouri River Basin Commission; Resource and Land Investigations Program (USGS), January 1979. 412 p, 14 Fig, 38 Tab, 96 Ref.

Descriptors: *Coal mines, *Montana, *North Dakota, *Wyoming, *Environmental effects, *Social aspects, Future planning(Projected), Economic impact, Land use, Data collections, Information exchange, Hydrogeology, Energy conversion, Geological surveys, Employment opportunities.

Methods for assessment of the impacts of western coal and energy development are identified and explained as a part of the Planning Reference System for planners and decision makers developed by the Western Coal Planning Assistance Project (WCPAP). WCPAP is designed to aid State and local planners and decision makers in the development of technical methods and information required to cope with coal-energy development problems. The project involves major coal areas in Montana, North Dakota, and Wyoming. An overview of the impact assessment process is followed by a guide to methods for assessing impacts on the human environment and on the natural environment. Human environment components include economic, demographic, facilities/services, land use, fiscal, social, and cultural. Natural environment components include soils, air, surface water, vegetation, wildlife, groundwater/geology, noise, and scenic/visual. In each component methods for impact projection are explained to assist planners. Some impact projection methods are explained in sufficient detail to allow the user to actually implement the technique. Of special value to planners is a definite method to estimate population changes caused by increased employment. A glossary of terms and an index are provided to give the user rapid access to the data and information in the planning reference system. (Seigler-IPA)
W80-02715

WESTERN COAL PLANNING ASSISTANCE PROJECT: FACT BOOK FOR WESTERN COAL/ENERGY DEVELOPMENT.
Mountain West Research, Inc. Billings, MT.
Missouri River Basin Commission; Resource and Land Investigations Program (USGS), January 1979. 560 p, 59 Fig, 39 Tab, 119 Ref.

Descriptors: *Coal mines, *Coals, *Montana, *North Dakota, *Wyoming, Data collections, Information exchange, Planning, Energy conversion, Environmental effects, Social aspects, Economic impact, Industrial water, Geological surveys, Transportation, Mining, Labor, Land use, Land management.

A wide range of coal-related facts are presented as part of the Planning Reference System for planners and decision makers developed by the Western Coal Planning Assistance Project (WCPAP). WCPAP is designed to aid State and local planners and decision makers in the development of technical methods and information required to cope with coal-energy development problems. The project involves major coal areas in Montana, North Dakota, and Wyoming. Coal related facts are presented in the areas of existing coal fields and mines, coal conversion including labor and water requirements, coal related facilities, transportation, legislation, and primary and secondary impacts such as environmental and socio-economic impacts. For each area a general perspective is presented followed by specific information relevant to the study area. Information is presented at an appropriate level of detail for local planners and decision makers, however, it is not highly technical. Fact sheets, charts, graphs, and tables are used to illustrate the data in each area. The book is designed to be a basic source information for those interested in coal resources and coal-related activities. (Seigler-IPA)
W80-02716

LIMNOLOGICAL AND SOCIOECONOMIC EVALUATION OF LAKE RESTORATION PROJECTS: APPROACHES AND PRELIMINARY RESULTS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-100415, Price codes: A16 in paper copy, A01 in microfiche. Report No EPA-600/3-79-005, January 1979. Proceedings, Limnological and Socioeconomic Evaluation of Lake Restoration Projects, Corvallis, OR, February 28 - March 2, 1978. Compiled by Peterson, S. A., 350 p, 115 Fig, 48 Tab, 274 Ref.

Descriptors: *Lake restoration, *Lake stages, *Eutrophication, *Evaluation, Limnology, Social aspects, Economic impact, Phosphorus compounds, Nutrient removal, Plant growth, Dredging, Water pollution, Lakes, Model studies, Storm runoff, Lake sediments, Watersheds(Basins).

The Environmental Protection Agency's Clean Lakes Program was evaluated at a three day workshop. The workshop included those persons directly associated with the program in order to discuss the various evaluation techniques being used and the various decision making criteria on lake restoration projects. Nineteen papers were presented and the Lake Evaluation Index was discussed. Limnological, social, and economic aspects of some lakes were considered. Major objectives of the Clean Lakes Evaluation Program are (1) to determine the effectiveness of specific restoration techniques or combinations of techniques on specific lakes and (2) to compare the effectiveness of various restoration techniques on different lakes. Due to lack of sufficient funding it was necessary to evaluate the 314 lake restoration projects as subsets or groups in terms of treatment technique, watershed type, geographic distribution, and sociological setting. The common factor in all lake restoration projects is the goal of reducing phosphorus supply to the lakes. A final assessment program objective is to compile a handbook to assist decision makers in predicting the consequences of employing various restoration methods. (Seigler-IPA)
W80-02742

NATIONAL WATERWAYS STUDY,
Institute for Water Resources, Fort Belvoir, VA.
A. L. Dietz.
Water Spectrum, Vol 11, No 4, p 26-35, Fall 1979. 10 Fig.

Descriptors: *Channels, *Inland waterways, *Navigable waters, *Transportation, Grains(Crops), Energy, Dams, Locks, Flood control, Dredging, Harbors, Coastal engineering, Great Lakes, Bodies of water.

The U. S. Army Corps of Engineers is conducting a study to develop a comprehensive framework for the future of transportation on the nation's waterways. Key factors in the future of water transportation planning are: (1) basic freight movement capability, (2) safety and reliability, and (3) potential defense and emerging roles. The nation now has in use nearly 26,000 miles of commercially navigable waterways. Annually approximately 1.9 billion tons of freight are moved with foreign trade and domestic trade being nearly equal in volume. Of the total waterborne commerce in 1977, energy related products accounted for 61%. The second largest commodity transported was grain. The National Waterways Study's first step is the development of an inventory of the existing waterway system. The study is designed to develop alternative strategies to meet commercial navigation requirements and to correlate these strategies with municipal and industrial water needs, hydroelectric power generation, recreation needs, flood control, and other non-transportation uses. Strategies designed from study results will be useful in realizing an effective water transportation system through 2000. (Seigler-IPA)
W80-02749

SAGEBRUSH TO CROPLAND -- A WESTERN WATER PROJECT,
Idaho Univ., Moscow. Water Resources Research Inst.
J. Francis, and R. Schermerhorn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-137565, Price codes: A03 in paper copy, A01 in microfiche. Report, March 1979. 30 p, 17 Fig, 2 Tab, OWRT C-6276 (5226) (1).

Descriptors: *Idaho, *Irrigation programs, *Project post-evaluation, Project benefits, Agriculture, Construction costs, Cost-benefit ratio, Irrigation water, Sprinkler irrigation, Irrigation effects, History, Economic impact, Environmental effects, Productivity.

The Boise Irrigation project begun in Idaho in the early 1900's now spreads water through 1800 miles of canals to 340,000 acres or 530 square miles. The project, one of the first large Bureau of Reclamation projects, was analyzed during the 1970s to determine its total impact and to develop methodologies to examine such projects. Lake Lowell, the first storage reservoir, was completed in 1908 and was followed by Arrowrock in 1915, Deadwood in 1931, Cascade in 1948, Anderson Ranch in 1950, and Lucky Peak in 1955. Benefits-costs ratios since 1910 show that prior 1941 return on output was low but from World War II until the present the benefit-cost ratio has been as high as 21.29 to 1 in 1947 and no lower than 4.85 to 1 in 1953. In 1973, the latest year calculated, the ratio was 9.94 to 1. Direct impacts of the project are seen in the farming of varied crops such as alfalfa, apples, wheat, prunes, onions, potatoes, barley, clover, corn, hops, lettuce, sugar beets, and mint. Three of the project's dams also have power generation facilities. Construction costs, charged to water users, have mostly been paid off. Some farmers still have to pay $0.75 per acre until 1991. Water costs are low with farmers in one area getting all the water they need for $14 per acre. Other benefits of the project include increased recreation activities and economic expansion. (Seigler-IPA)
W80-02772

FLORIDA'S WATER RESOURCES RESTORATION PROGRAM,
Florida State Dept. of Environmental Regulation, Tallahassee. Water Resources Restoration and Preservation.
A. J. Tolman.
In: Lake Restoration, Report No EPA 440/5-79-001, p 39-40, 1979.

Descriptors: *Florida, *Water management(Applied), Eutrophication, Lake stages, Coasts, Coastal marshes, Water quality control, Environmental effects, Government supports, Grants, Administration, Lakes, Bayous, Marshes, Urbanization, Sedimentation.

The Florida Water Resources Restoration and Preservation Program (WRR and P), established in 1977, has completed three projects with 10 others in progress. Florida has 11,000 miles of coastline and approximately 7,000 lakes of at least 10 areas. Both areas of water resources are covered by the program. Program funding comes from general revenue from the State, Federal money from the Environmental Protection Agency's clean lakes program, and from the State pollution recovery fund. Major WRR and P employees are: an administrator, an administrative assistant, two secretaries, a limnologist, a marine biologist, a civil engineer, a field project director, and an attorney. In 1978, the WRR and P rule was adopted which sets the limitations of funding, the criteria for project selection, and the application form for use in applying for funds. Lake Apopka which is hypereutrophic will be aided by 50% funding from a section 314 Federal grant. The probable course of corrective action will be a drawdown which is currently being studied. Lake Jackson, suffering from heavy sedimentation and a general decline in water quality due to rapid urbanization, has also received Federal funding. Two large sedimentation basins are to be built along with a marsh biofiltration system. (See also W80-02773) (Seigler-IPA)
W80-02780

SOUTH DAKOTA'S LAKE PROGRAM,
South Dakota Dept. of Environmental Protection, Pierre.
J. R. Seyfer.
In: Lake Restoration, Report No EPA 440/5-79-001, p 43-45, 1979.

Descriptors: *South Dakota, *Water management(Applied), *Government supports, *Grants, Eutrophication, Lakes, Lake stages, Sediments, Sedimentation rates, Water quality control, Agriculture, Legislation, Recreation.

In 1975, South Dakota created the State Lake Preservation Committee to: (1) identify the eutrophication problems in the Prairie Coteau, a region of glacial lakes; (2) inventory and classify Coteau lakes from existing data; (3) develop lake prioritizing criteria for preservation and restoration; and (4) assure adequate agency authority for the implementation of restoration projects. A lake protection and rehabilitation grant program was established in 1978 to provide the needed project funding, South Dakota has approximately 800 publicaly owned lakes of which 90% have been designated eutrophic by the Department of Environmental Protection. Land runoff of sediment and agricultural chemicals is the major cause of eutrophication. To combat this particular problem a special requirement for funding is the approval of the project by the affected conservation district and the identification of both point and nonpoint water pollution sources. Proposed projects are rated by a point system that takes into account lake surface area, depth, fisheries classification, public accessibility, population, and other criteria. A public hearing must be held for each project and State and Federal funding percentage requirements must be met. The 208 Water Quality Management Plan is also active in South Dakota. Through the 208 plan, a Model Implementation Program was awarded for Lake Herman. Project funding will come from a wide variety of agencies and will be used to provide the best management practices possible. Dredging, lakeshore riprapping, and placement of sediment control structures are planned. (See also W80-02773) (Seigler-IPA)
W80-02782

VERMONT LAKES AND PONDS PROGRAM,
Vermont Dept. of Water Resources, Montpelier.
J. W. Morse.
In: Lake Restoration, Report No EPA 440/5-79-001, p 47-50, 1979. 1 Ref.

Descriptors: *Vermont, *Water management(Applied), Lakes, Lake stages, Eutrophication, Water quality control, Recreation, Freshwater, Planning, Administration, Phosphorus, Dissolved oxygen, Monitoring, Chlorophyll.

To assure recreation potential, monitor trophic status, and develop restoration projects where needed for its 527 freshwater lakes, Vermont has established a Lakes and Ponds Program. The program is divided into three phases. The first phase, Lakes and Ponds Surveillance, monitors water quality to identify lakes that may have problems. Each year 30 to 35 lakes are sampled and results are distributed publically in the form of summary sheets. In phase two, Lakes and Ponds Studies, the results from selected phase one lakes receive documentation and a more intensive study is conducted using water quality data, historical information, and predictive models. From this study, public lake reports are prepared that satisfy the U.S. Environmental Protection Agency's New England requirement for background information and the Vermont's Aquatic Nuisance Control Program requirement for a biological survey. In phase three, Management and Restorative Action, lake management and restorative programs are developed, initiated, and administered for a limited number of problem lakes. Additional satellite lake programs are: a Phosphorus/Chlorophyll Modeling Program, a Hypolimnetic Dissolved Oxygen Program, a Lay Monitoring Program, and a Lake and Pond Inventory Program. (See also W80-02773) (Seigler-IPA)
W80-02783

INTEGRATION OF ASSISTANCE PROGRAMS TO ACHIEVE WATER QUALITY STANDARDS,
Environmental Protection Agency, Washington, DC.
L. J. Guarraia.
In: Lake Restoration, Report No EPA 440/5-79-001, p 55-57, 1979.

Descriptors: *Government supports, *Water management(Applied), *Governmental interrelations, Water quality control, Lakes, Planning, Grants, Legislation, Agriculture, Governments, Sewage effluents, State governments, Water quality act.

Water quality standards are set by each state based on the desired use of a body of water. From these standards a state can then determine the water quality criteria necessary to meet the standards. Once the standards and criteria have been determined, appropriate steps must be taken to protect the body of water for its selected use. Possible steps include preventing runoff from the watershed, control of wastes from industry and agriculture, and control of sewage treatment plant wastes. The Environmental Protection Agency's clean lakes program is designed to help states with setting water quality standards, determining the needed criteria, and the necessary steps. Also, the program provides funding to help states carry out the necessary steps such as to control of nonpoint source pollution in watersheds and the correction of in-lake pollution problems. Other programs, agencies, and services that can be integrated with the clean lakes program include: the 208 water quality management program; the National Pollutant Discharge Elimination System (NPDES) permits program; the 201 construction grants program; the Agriculture Soil and Conservation Services; the Community Development Block Grant program; the Appalachian Commission; the Land and Water Conservation Fund; the Agriculture Stabilization and Conservation Service; the Energy, Environment, and Natural Resources Program; and the Land and Water Conservation Fund. (See also W80-02773) (Seigler-IPA)
W80-02785

THE FUTURE OF THE CLEAN LAKES PROGRAM,
Environmental Protection Agency, Washington, DC. Criteria and Standards Div.
K. M. Mackenthun.
In: Lake Restoration, Report No EPA 440/5-79-001, p 59-62, 1979. 7 Ref.

Descriptors: *Federal Water Pollution Control Act, *Government supports, *Water quality control, Legislation, Grants, State governments, Lakes, Lake stages, Monitoring, Management, Administration, Planning, Water pollution, Waste water(Pollution), Water pollution control.

States such as Wisconsin and Minnesota began taking actions to improve their lakes early in the 1900s and were rapidly followed by numerous other states. The Federal government became involved in 1972 with the enactment of the Federal Water Pollution Control Act. In 1975, Federal financial support became available to states for their water quality programs. Since then $36.3 million have been appropriated for this purpose. Actual project costs are approximately twice this amount since Federal support represents only about 50% of the total funding. Federal funding through the Environmental Protection Agency's clean lakes program has been used to support water quality restoration projects in 73 lakes in 23 states. The program is primarily directed toward the control of nonpoint pollutants and the implementation of methods to hasten lake recovery after the control of the pollutants. In 1978 EPA made funds available to states to inventory the extent and nature of eutrophication in significant lakes and to support feasibility studies for those methods most suited to restore lake water quality. EPA is currently developing regulations for the future management of the clean lakes program. Increased EPA/State agreements should make the program more effective. Future program focus will deal strongly with the impacts of nonpoint source pollutants and on the methods, management planning, and implementation of best management practices to correct the pollution sources. (See also W80-02773) (Seigler-IPA)
W80-02786

EPA'S LAKE RESTORATION EVALUATION PROGRAM,
Corvallis Environmental Research Lab., OR.
S. A. Peterson.
In: Lake Restoration, Report No EPA 440/5-79-001, p 187-193, 1979. 1 Fig, 4 Tab, 15 Ref, 1 Append.

Descriptors: *Eutrophication, *Water management(Applied), *Water pollution, *Evaluation, Treatment, Lakes, Lake stages, Social aspects, Economic impact, Nutrients, Phosphorus, Dissolved oxygen, Secchi disks, Limnology, Chlorophyll, Nitrogen.

The overall effectiveness of the Environmental Protection Agency's lake restoration program is being assessed. The 60 lakes in the program as of September 1975 were grouped into similar types according to restoration techniques used. The three groups are: (1) source controls, (2) in-lake controls, and (3) problem treatment (directed at biological consequences of lake condition). Representative projects were selected and are being evaluated for each group. The lakes are evaluated limnologically, sociologically, and economically through the use of research grants. Mass balance modeling of nutrients, especially phosphorus is used as an evaluation tool. A lake evaluation index that includes Secchi depth, dissolved oxygen, phosphorus, chlorphyll a, and nitrogen compounds is also used. The attitudes of lake uses concerning lake restoration are used in the socioeconomic evaluations. As a product of the lake restoration evaluation program a water quality manager's handbook will be compiled to help managers optimize the recreational potential of lake restoration. (See also W80-02773) (Seigler-IPA)
W80-02801

MONITORING OF HYDRAULIC DREDGING FOR LAKE RESTORATION,
Union College, Schenectady, NY. Dept. of Civil Engineering
P. D. Snow, R. P. Mason, C. J. George, and P. L. Tobiessen.
In: Lake Restoration, Report No EPA 440/5-79-001, p 195-204, 1979. 10 Fig, 4 Tab, 6 Ref.

Descriptors: *Dredging, *Lake sediments, *Runoff, Bottom sediments, New York, Water pollution effects, Nutrients, Lakes, Lake stages, Phosphorus, Settling basins, Aquatic plants, Pondweeds, Secchi disks, Dissolved oxygen, Environmental effects, Phytoplankton, Zooplankton.

The dredging restoration program for Collins Lake, an oxbow lake of the Mohawk River in

Scotia, New York, is being monitored to determine its impact. The lake is a recreational asset to the area and is used for swimming, boating, and fishing. Water pollution from runoff and nutrients stored in bottom sediments in shallow areas is causing lake deterioration. Overwhelming populations of water chestnut and curly-leaved pondweed have occurred. Outbreaks of Pediastrum simplex are also a problem. Restoration plans include the removal of 100,000 cu cm of accumulated organic matter by means of a hydraulic dredge developed by Mud Cat Division, National Car Rental, Inc. Dredging began in 1977 with the dredged material being pumped into a decanting or settling lagoon. Thus far approximately 40,000 cu cm have been removed. Physical, chemical, and biological parameters are being monitored at four lake stations twice a month. Monitored parameters include conductivity, dissolved oxygen, soluble orthophosphate, total phosphorus, alkalinity, acidity, pH, hardness, temperature, Secchi disk depth, numbers and kinds of plankton, and other parameters. It is too soon to make definite conclusions about the success or failure of the ongoing dredging restoration project. (See also W80-02773) (Seigler-IPA)
W80-02802

ENVIRONMENTAL QUALITY AND RESIDUALS MANAGEMENT,
Resources for the Future, Washington, DC.
A. V. Kneese, and B. T. Bower.
Johns Hopkins University Press, Baltimore and London, 1979. 338 p, 47 Tab, 29 Fig, Append.

Descriptors: *Residuals, *Residuals management, *Models, *Social aspects, *Mathematical models, *Delaware Valley, *Water quality, *Environmental quality, Management, Pollution, Resource allocation, Political aspects, Water quality, Lower Delaware Valley, Industrial plants, Industrial wastes, Industries, Linear programming.

The useful and practical ways to apply residuals management techniques on national, state and local community levels are analyzed. Residuals problems are seen as not being dealt with adequately by the free market system because of failure to account for the value of 'common property resources' such as air, land and water. Basic thrusts of the research program were (1) micro and regional analyses, (2) collective choice theory, and (3) basic economic theory and macroanalyses. Integrated residuals management at the micro (i.e. plant) level and technologies and costs of integrated residuals management are presented. The most important type of regional analysis was the building of a quantitative regional residuals-environmental quality management (REQM) model, intended for the analysis of alternative policies for residuals management; relationships among costs, environmental quality levels and type of management strategy; and distribution of costs and benefits. The formal structure of the model is described, followed by an extended theoretical discussion of its political and institutional aspects. The model was applied to the Lower Delaware Valley region; an aquatic ecosystem model of the Delaware Estuary was also developed. The model showed substantial variation in both air and water quality in the region. Ambient water quality standards in the estuary can be met by using various combinations of methods. Regional alternatives would be more economical than residuals discharge reduction at individual sites. A macro model of residuals discharges and discharge reduction costs is presented; and, finally, it is suggested that national accounting measures incorporate residuals management costs in industrial, governmental and consumer expenditures. (Arnold-NC)
W80-02846

ENERGY PRODUCTION AND WATER RESOURCES IN THE COLORADO RIVER BASIN,
Los Alamos Scientific lab., NM.
For primary bibliographic entry see Field 6D.
W80-02859

AN OVERVIEW OF RIVER-BASIN ASSESSMENT TECHNIQUES IN AN ENERGY-IMPACTED REGION--YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO.
For primary bibliographic entry see Field 6A.
W80-02865

SOCIAL ASSESSMENT AND RESOURCE POLICY: LESSONS FROM WATER PLANNING,
Michigan Univ., Ann Arbor. School of Natural Resources.
G. A. Daneke, and J. D. Priscoli.
Natural Resources Journal, Vol 19, No 2, p 359-375, April 1979. 1 Fig.

Descriptors: *Policy, *Social assessment, *Social aspects, *Decision making, *Water resources planning, *Water resources development, *Planning, Social impact, Social values, Economics, Management, Cost-benefit ratio, Water resources, Assessment, Analysis, Water, Benefits, Public benefits.

Water resource development agencies have advanced the state-of-the-art in social well-being and quality of life accounting systems. As social and environmental assessments become widely utilized, the importance of presently held distinctions between land, air and water planning, as well as natural vs. built systems, will diminish. Various forms of social accounting have emerged as alternatives to traditional resource assessment strategies. Social assessments can identify a range of value concerns not often expressed in the standard economic account. A variety of distinct life-quality accounting methodologies have also emerged. Some of the more widely used techniques are: (1) social profiling, (2) institutional analysis, (3) community assessment, (4) construction impact analysis, (5) mitigation design, and (6) survey research. However, there is no guarantee that the results of life-quality accounts will be given full weight in the decision-making process; some contend that they are too amorphous and subjective to warrant practical acceptability. These social indicators expand understanding of the distribution of costs and benefits. Social information will earn public confidence if it is used to display and help adjudicate conflicting claims, to design socially useful projects and programs which produce minimal social disruptions, and to explore means of enhancing the general quality of life. (Iervolino-NC)
W80-02868

LAKE REHABILITATION: A STATUS REPORT,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 2H.
W80-02869

PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOUTHEAST RIVER BASINS: SAVANNAH BASIN, APPENDIX 1.
1963. 212 p, 117 illustrations, 48 Tab.

Descriptors: *Water resources development, *Water policy, *River basin development, *Comprehensive planning, *Management, *Savannah River, Water resources, Administration, Legislation, Natural resources, Multiple-purpose projects, Project purposes, Social aspects, Programs, Coordination, Navigation, Water supply, Recreation, Flood control, Irrigation, Land resources, Hydroelectric power, Soil conservation, Fish management, Wildlife management, Salinity, Sediment control, Water pollution, Hurricanes, Beach erosion.

This appendix summarizes studies made in formulating a comprehensive plan for the development of water and related land resources of the Savannah River Basin. Part One sets the stage for development. The basin area, its resources, people and economy are described. Part Two outlines needs and opportunities. Problems reviewed are flood control and prevention, water supply, navigation, reclamation, irrigation and drainage, hydroelectric power and industrial development, soil conservation and use, fish and wildlife, recreation, salinity and sediment control, pollution abatement and public health, beach erosion control and hurricane protection. Part Three describes planning procedures as applied to this study. Objectives and guidelines are outlined, planning assumptions and criteria presented and plan formulation evaluated. Part Four discusses the comprehensive basin plan. The impacts of the plan on all the factors listed above are assessed. More general economic and physical impacts are studied. Plan implementation suggestions are presented, followed by recommendations for specific projects and programs. The last part studies the possibility of local, state and federal participation and assistance. (Zayac-NC)
W80-02877

PRELIMINARY REPORT: WATER SYSTEM IMPROVEMENTS, CITY OF LEWISBURG, WEST VIRGINIA.
Martin (Deward M.), and Associates, Inc., Beckley, WV.
For primary bibliographic entry see Field 6D.
W80-02878

THE ECONOMIC EFFECTS OF WEATHER MODIFICATION ACTIVITIES, PART I – CROP PRODUCTION IN THE BIG SPRING-SNYDER AREA,
Texas Dept. of Water Resources, Austin.
W. Allaway, L. Lippke, R. Riggio, and C. Tuck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112048, Price codes: A04 in paper copy, A01 in microfiche. Report No WR-1, November, 1975. 59 p, 4 Fig, 5 Tab, 14 Ref, 2 Append.

Descriptors: *Weather modification, *Texas, *Rainfall, *Crop production, Cotton, Grain sorghum, Wheat, Agriculture, Input-Output analysis, Economic impact, Regression analysis, Precipitation(Atmospheric), Farms, Crops, HIPLEX.

As a part of the High Plains Cooperative Program (HIPLEX) agricultural production in 14 counties of the Big Spring-Synder area of Texas was studied to estimate the value of additional crop yields and the economic effects resulting from hypothetically-induced increases in rainfall. Crop production and harvested acreage in each county were obtained from the Texas Crop and Livestock Reporting Service for cotton, grain sorghum, and wheat Multiple regression analysis was used to estimate crop yield increases due to increased rainfall from weather modification. These estimates of yield increases were then converted to monetary values for use in an input-output model to provide economic activity estimates resulting from the increased crop revenues. Overall results show that substantial direct increases would occur in agricultural incomes with the proposed increases in precipitation. Rainfall increases prior to crop planting or during the growing season would result in the greatest crop responses. For cotton and grain sorghum this would be January through March and June through August, however, increased precipitation during harvesting would be harmful. The greatest economic benefits from increased rainfall in a single month would be seen for March with a 10% increase in rainfall producing $323,000 in increased revenues. Total region effects (income, employment, and spending) for a 10% March rainfall increase would be approximately $500,000. (See also W80-02995) (Seigler-IPA)
W80-02994

THE ECONOMIC EFFECTS OF WEATHER MODIFICATION ACTIVITIES, PART II – RANGE PRODUCTION AND INTERINDUSTRY ANALYSIS,
Texas Dept. of Water Resources, Austin.
L. Lippke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112055, Price codes: A05 in paper copy, A01 in microfiche. Report No WR-2, August 1976. 89 p, 7 Fig, 14 Tab, 33 Ref, 3 Append.

Descriptors: *Weather modification, *Texas, *Rainfall, *Range management, *Forage grasses, Forages, Livestock, Economic impact, Precipitation(Atmospheric), Regression analysis,

Browse utilization, Rain, Water shortage, HIPLEX.

As a part of the High Plains Cooperative Program (HIPLEX) range production in 14 counties of the Big Spring-Synder area of Texas was studied to determine the direct income and total economic effects resulting from hypothetically-induced increases in rainfall. Precipitation in the area varies from 14 to 22 inches annually. Forage yield of the rangeland has a direct bearing on the output and costs of the livestock industry. Multiple linear regression with rainfall and range conditions from 1941 through 1971 was used to estimate the change in range forage production due to increased rainfall from weather modification. A method based on an estimate of the additional number of animal units months of grazing resulting from the improved range conditions was used to convert these estimates to monetary values. Major study results are: (1) rainfall during the spring months is very important to the condition of the range for the remainder of the year; (2) previous year range condition has a significant impact on current range condition; and (3) a 10% rainfall increase during the month of April (0.16 in) would result in an income increase of $299,100. Interindustry analysis results show that a 10% rainfall increase in March would produce an increase in overall regional production of $455,000. Total output benefits in the area resulting from a 10% increase in March rainfall are about $1.7 million while total income would increase by $984,000. (See also W80-02994) (Seigler-IPA)
W80-02995

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

FRESH WATER EXPORT BY OIL TANKERS,
California State Univ., Chico. Dept. of Civil Engineering.
M. Mow.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134422, Price codes: A03 in paper copy, A01 in microfiche. Land and Water Resources Institute, University of Maine, Orono. Completion Report, October 1979. 27 p, 6 Fig, 4 Tab, 9 Ref, 1 Append, OWRT A-043-ME (2).

Descriptors: *Freshwater, *Ships, *Oil, *Arid lands, *Export, Foreign trade, Import, Harbors, Deep water, Atlantic Ocean, Gulf of Mexico, Northeast U.S., Pipes, Model studies, Economics, Cost repayment, Very large crude carriers, Water utilization, Oil pollution, Water pollution sources.

An economic model was developed to study the potential for fresh water export to arid oil exporting nations by returning oil tankers. Currently Very Large Crude Carriers (VLCC) are ballasted with salt water for their return trip, however, most tanker ports in the U.S. are located in 'water excess' zones such as the Gulf Coast and the North Atlantic states giving easy access to fresh water loading. Costs associated with water export are those for pipes, right-of-ways, intake towers, and water treatment facilities. The model estimates the capital expenditure necessary for a water export facility and the water rate (dollars/1000 gallons) required to liquidate that capital. The model has six components that are described in detail. Results of a North Atlantic deep water port example are given to illustrate the model with non-site-specific conditions being estimated. It is concluded that fresh water export to the Middle East could be economically feasible if deep water ports that are developed have nearby adequate fresh water supplies and fresh water contamination by cargo tank residues can be prevented. Also the export of fresh water in tankers instead of a salt water ballast would eliminate water pollution caused by dumping of the ballast in the ocean. (Seigler-IPA)
W80-02769

CURRENT ISSUES IN U.S. ENVIRONMENTAL POLICY.
For primary bibliographic entry see Field 6E.
W80-02847

6D. Water Demand

INCREASING WATER AND SEWER RATE SCHEDULES: A TOOL FOR CONSERVATION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 3D.
W80-02857

ENERGY PRODUCTION AND WATER RESOURCES IN THE COLORADO RIVER BASIN,
Los Alamos Scientific lab., NM.
D. Abbey.
Natural Resources Journal, Vol 19, No 2, p 275-314, April 1979. 5 Fig, 13 Tab.

Descriptors: *Colorado River Basin, *Energy production, *Water allocation(Policy), *River basin development, *Water consumption(Plants), *Water use, Water resources, Water utilization, Energy, Colorado, Water depletion, Water supplies, Energy industry, Water policy, Electricity, Electric power, Electric power costs.

Since 1962, over 10,000 megawatts (MW) of coal-fired electric generating capacity have been installed in the Colorado Basin, with an additional 19,000 MW under construction or planned. Energy development poses a host of water-related problems, the most fundamental being adequacy of freshwater supplies. Besides energy production, water must be allocated for instream uses such as recreation, aesthetics, and fish and wildlife. The intent of this paper is to demonstrate the applicability of the substitution process to water use in the energy industry, and to provide some insight into patterns of future water use and potential for water conservation in energy production. Discussion of water demand at a coal-fired plant focuses on factors that influence the level of process and plant consumption and the incremental costs of reducing consumption or using a lower quality water supply. Four principal processes comprise the water utilization system of a coal-fired electric generating plant; the greatest potential for reducing consumption is substitution of air or dry cooling for wet or evaporative cooling. Availability and cost of alternative water supplies in the Basin are discussed including surface water, reallocation of water, and groundwater. Water system elements for new electric plants projected to come on-line are presented and the influence of water use costs on electricity prices are discussed. The author concludes that no compelling justification for controlling water use of the energy industry is provided, and that if such controls are to be justified, they must come from a quantitative examination of the value of water to all users, not just the energy industry. He contends that the impact of energy development on allocation of water resources in the Basin has been overrated and misrepresented. (Iervolino-NC)
W80-02859

AN OVERVIEW OF RIVER-BASIN ASSESSMENT TECHNIQUES IN AN ENERGY-IMPACTED REGION--YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO.
For primary bibliographic entry see Field 6A.
W80-02865

PRELIMINARY REPORT: WATER SYSTEM IMPROVEMENTS, CITY OF LEWISBURG, WEST VIRGINIA.
Martin (Deward M.), and Associates, Inc., Beckley, WV.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 601, Price codes: A12 in paper copy, A01 in microfiche. Economic Development Administration Technical Assistance Project, Department of Commerce. Prepared for City of Lewisburg, West Virginia, April 1977. 158 p, 9 Plates, 3 Maps, 8 Tab, 4 Fig, 3 Append, 01-6-01446.

Descriptors: *Lewisburg(WV), *West Virginia, *Water supply development, *Economics, *Feasibility studies, *Planning, *Project planning, *Distribution systems, Water supply, Water treatment, Water distribution(Applied), Water delivery, Financing, Water works, Water demand, Administration, Costs.

The City of Lewisburg owns and operates the only public water supply in a large populated area of Greenbrier County, WV, serving approximately 7,000 people. It is totally inadequate to provide proper domestic service and fire protection to present customers. Recent improvements helped alleviate some emergency conditions which existed but did not eliminate the gross deficiencies in the system. Population is expected to increase from 4,706 in 1977 to 5,640 by 1990, with an increase in the Lewisburg water system from 7,980 to 9,680 by 1995. City water records indicate an average water use of approximately 430,000 gallons per day (gpd) and a peak daily use in excess of 700,000 gpd. By 1995 the waterworks should have a capacity for an average daily use of .968 mgd and a peak daily use of 1.45 mgd. Based on studies of the supply, treatment and distribution systems and financial analyses, it was recommended that construction of new waterworks facilities be divided into three phases. Phase I would include a new water supply intake structure, an additional filter at the current water plant, a new high level transmission system, and storage on both the high and low level systems. The Phase II project would include construction of new strengthening mains for fire protection in both Lewisburg and Fairlea. Phase III would include a new water treatment plant, a second major water supply transmission main, and major distribution system improvements in the northern part of the service area. Water distribution mains in the Caldwell area should be included. Total cost for the proposed project improvements is $6,511,600. The city would be eligible to apply for federal funds through four different agencies. (Iervolino-NC)
W80-02878

6E. Water Law and Institutions

STATUS REPORT ON COMPLIANCE WITH THE CHLOR-ALKALI MERCURY REGULATIONS 1976-77.
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Available from Environmental Protection Service, Department of the Environment, Ottawa, Ontario, Canada, K1A 1C8. Economic and Technical Review Report EPS 3-WP-79-8, October 1979, English and French, 14 p, 3 Fig, 3 App.

Descriptors: *Regulation, *Mercury, *Effluents, Industrial wastes, Measurement, Efficiencies, Compliance, Comparative studies, Canada.

This report reviews the results of the measures taken by industry and government agencies to curtail mercury losses in liquid effluents from chlor-alkali plants in Canada. A similar status report was issued for the year 1975. Mercury losses in liquid effluents have been reduced by over 99 percent since 1970. Plant records and regulatory monitoring by both federal and provincial environmental control agencies have confirmed this reduction. The drastic reduction in mercury purchases and consumption since 1970 is the result of the installation of efficient treatment systems, and increased recovery of mercury from waste gases and solids; seven plants have also terminated production or converted from the mercury to the diaphragm cell process. (WATDOC)
W80-02835

STATUS REPORT ON ABATEMENT OF WATER POLLUTION FROM THE CANADIAN PETROLEUM REFINING INDUSTRY - 1977.
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Available from Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada K1A 1C8. Economic and Technical Review Report EPS 3-WP-79-5, July 1979, English and French, 39 p, 7 Fig, 6 Tab.

Descriptors: *Industrial wastes, *Pollutants, *Oil, Compliance, Industrial plants, Regulation, Storm water, Toxicity, Analytical techniques.

Effluent regulations and guidelines to limit the discharge of pollutants from the Canadian petroleum refining industry were issued under the Federal Fisheries Act in 1973. This report presents an assessment of the progress made to the end of 1977 in meeting the discharge objectives, and provides projections of the anticipated status by 1980. (WATDOC)
W80-02836

ENVIRONMENTAL QUALITY AND RESIDUALS MANAGEMENT,
Resources for the Future, Washington, DC.
For primary bibliographic entry see Field 6B.
W80-02846

CURRENT ISSUES IN U.S. ENVIRONMENTAL POLICY.
Published for Resources for the Future, Washington, DC., by Johns Hopkins University Press, Baltimore, 1978. P. R. Portney, editor. 207 p.

Descriptors: *Air pollution, *Water pollution, *Environmental control, *Environmental effects, *Environmental policy, *Policy, *Clean Air Act, *Water Pollution Control Act, *Economic impacts, *Pollution abatement, Legislation, Cost-Benefit analysis, Cost allocation, Water policy, Governments, Institutional constraints, Environmental quality, Models, Macroeconometric models, Air pollution effects, Emissions control.

Existing federal policies regulating air and water pollution and exposure to toxic substances are discussed and analyzed. One emerging problem is potential conflict between the desirability of having clear and specific statements of objectives from Congress and the need for the administrative agencies to be flexible in dealing with individual cases under changing conditions. Such legislation as the Clean Air Act Amendments do not include a system for weighting of the costs of achieving standards against anticipated favorable effects, and threshold pollutant levels for the public are set without adequately considering evidence that subthreshold levels of some pollutants are deleterious. Under the Water Pollution Control Act Amendments the goal of 'zero discharge' may not be either feasible or desirable and could entail far more costly technology than originally envisioned. Mandatory installation of certain technologies without consideration first of costs and benefits does not make economic sense and could weaken incentives for firms to make innovations in pollution control technology. The federal subsidy program for waste treatment plants encourages communities to choose treatment facilities with high capital costs relative to operating and maintenance costs. Benefits and costs should be carefully balanced. Market-like incentives for pollution abatement are recommended. Automotive air pollution problems are discussed and recommendations are made for emissions criteria. The Toxic Substances Act and other legislation relating to toxic and hazardous substances are reviewed and alternatives for control are considered. U.S. environmental policy is evaluated in relation to the national economy. Recommendations include better coordination and information collection. (Arnold-NC)
W80-02847

MODELS FOR WATER RESOURCES DECISION-MAKING: PROBLEMS AND PROJECTS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 6A.
W80-02860

A RATIONAL APPROACH TO WATER QUALITY CONTROL,
Birmingham Univ. (England). Dept. of Civil Engineering.
T. H. Y. Tebbutt.
Water Supply and Management, Vol 3, No 1, p 41-53, 1979. 7 Ref, 8 Fig, 2 Tab.

Descriptors: *Water pollution control, *Water quality control, *Rational formula, *Pollution abatement, *Water pollution, *Water quality, Mathematical models, Effluents, Environmental control, Biochemical oxygen demand, Pollutants, Water resources, River flow, Water quality standards.

Water technologists have a responsibility to the community for the expenditure of public money and they have a duty to resist the adoption of costly and complex water quality control measures. The control of water pollution should be based on consideration of the nature and volume of the discharge, available dilution in the receiving water, downstream water usage and, in the case of non-conservative pollutants, the self-purification characteristics of the system. It is reasonable therefore to decide upon the quality required in a particular water course and then to control discharges to the water to ensure that the desired quality is maintained. When formulating water quality control measures in a receiving water the value of river discharge selected for the establishment of effluent standards is of considerable significance. A more basic examination of water quality control measures can be made if arbitrary standards on receiving water quality are abandoned and the system is operated on the basis of an optimizing model. Mathematical models should be produced which describe all the natural and man-made factors which operate in the system together with the associated costs and benefits. Rational least cost approach to water quality control can be helpful in preventing at least some of the excesses of current environmental legislation. (Iervolino-NC)
W80-02861

NORTH AMERICAN WATER TRANSFERS: AN OVERVIEW,
Biswas and Associates, Ottawa (Ontario).
A. K. Biswas.
Water Supply & Management, Vol 2, No 2, p 79-90, 1978. 1 Fig, 2 Tab, 20 Ref.

Descriptors: *Water transfer, *Imported water, *Interbasin transfers, *North American Water and Power Alliance(NAWAPA), *Water resources, *Water demand, Water supply, Legal aspects, Technical aspects, Socio-economic aspects, Political aspects, Environmental aspects, Water utilization, Water development, Water supply development.

A water transfer may be defined as an interbasin diversion--the artificial withdrawal of water by ditch, canal or pipeline from its source in one contributing or exporting drainage basin for use in another receiving or importing basin. Before water transfers can be considered three factors must be analyzed: assessments of available water resources, the nature of the demand function, and the efficiency of water use. Urban centers account for most of the long distance water importations. Several current interbasin diversions are discussed. The most ambitious of the proposed interregional transfers is the North American Water and Power Alliance (NAWAPA) first proposed in 1964. The general idea of the $100 billion project is to collect surplus water from the high precipitation areas of the northwestern part of the North American continent and distribute it to water-scarce areas of Canada, the U.S. and northern Mexico. A series of dams and power stations in Alaska and northern British Columbia would collect water and provide power to pump this water up to the Rocky Mountain Trench Reservoir in southeastern British Columbia. From there the water would be lifted by pumps to the Sawtooth Reservoir in central Idaho, from which it would flow by gravity to the western States. Problems associated with such large transfers fall into four separate headings: technical, socio-economic, political and legal, and environmental. These constraints result in the unlikelihood that such large scale water transfer schemes will be implemented within the foreseeable future in the United States. (Iervolino-NC)
W80-02870

COMPREHENSIVE WATER AND RELATED LAND RESOURCES INVESTIGATION, CONNECTICUT RIVER BASIN. VOLUME I: MAIN REPORT.
New England River Basins Commission, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 894, Price codes: A17 in paper copy, A01 in microfiche. June 1970. 394 p, 20 Fig, 40 Tab, 1 Plate.

Descriptors: *Connecticut River, *Water resources development, *River basin development, *Comprehensive planning, Administration, Conservation, Federal government, Governments, Legislation, Natural resources, Multiple-purpose projects, Social aspects, Water policy, Water resources, Population, Economics, Land resources, Physiographic provinces, Water resources.

This report is the result of a six-year comprehensive investigation of the 11,250 square mile Connecticut River Basin together with a Plan of Development of the water and related land resources. Short- and long-term resource needs are identified and a plan is presented for the best uses of these resources. Programs and projects recommended for initiation in the next 10-15 years are included, and potential measures to meet the basin's needs to the year 2020 are identified. This Main Report is drawn from 19 separate appendices and is divided into a summary and 11 chapters, with each chapter divided into three parts. Part One first surveys the background legislation and related water law and policy. The basin is described in a general sense; a chapter on physiography presents the basin's land form. Part Two looks at the basin's population, both present and projected, and studies the economy in light of these figures. Needs and problems of the basin are discussed, followed by a chapter exploring various devices or options available to meet needs. A chapter on alternative plans follows, with alternatives ranked on both cost- and social-effectiveness bases. Part Three presents the coordinated basin plans, the 1980 Early Action Plan and the 2020 Long Range Plan. The economic impacts are discussed as well as the priorities which must be met to keep open the options allowing for wise growth and maintenance of environmental quality. Methods of scheduling and implementing the plan are suggested. Participant views are then presented, followed by recommendations for Congress. (Zayac-NC)
W80-02874

COMPREHENSIVE WATER AND RELATED LAND RESOURCES INVESTIGATION, CONNECTICUT RIVER BASIN, VOLUME VII: APPENDICES--K: PLAN FORMULATION; L: NAVIGATION.
New England River Basin Commission, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 895, Price codes: A18 in paper copy, A01 in microfiche. June 1970. 400 p.

Descriptors: *Connecticut River, *Water resources development, *Comprehensive planning, *River basin development, *River basins, Connecticut, Massachusetts, Long-term planning, Short-term planning, Coordination, Administration, Estimated benefits, Estimated costs, Institutions, Legislation, Management, Methodology, Social aspects, Navigable rivers, Recreation, Boating, Water supply, Flood control, Anadromous fish, Wildlife, Public health.

This Volume VII is part of a 6-year comprehensive investigation of the Connecticut River Basin together with a Plan of Development of the water and related land resources. Appendix K deals with Plan Formulation. The planning environment is first assessed as planning authority, guiding documents and study controls are discussed. The present environment is inventoried. Basin water resources, the natural environment, historical and cultural development, and economic development are reviewed. Factors of change are deliberated in a chapter that outlines social and demographic trends, economic trends, technological changes and urbanization. Needs of the future are evaluated in each of the following areas: power, recreation, environmental preservation, fisheries, wildlife,

water supply, navigation, land management, solid waste disposal, public health, estuaries, flood control and flow regulation and augmentation. Elements of the basin plan are identified, along with its objectives, goals and short- and long-term perspectives. Benefits and costs are summarized and alternatives for substantive areas suggested. Appendix L is divided into four sections. The first reviews improvements both in commercial and recreational navigation on the Connecticut River from Long Island Sound to Hartford. Section II assays recreational and commercial navigation on the river from Hartford to Holyoke, MA. Section III discusses recreational boating on the main stem and the federal permit program on the river above Holyoke. The final section reviews canoeing possibilities, both existing and prospective, on tributary streams. (Zayac-NC)
W80-02875

PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOUTHEAST RIVER BASINS: SAVANNAH BASIN, APPENDIX 1.
For primary bibliographic entry see Field 6B.
W80-02877

WATER ALLOCATION AND MANAGEMENT IN THE SOUTHEAST,
North Carolina State Univ. at Raleigh; and North Carolina Univ. at Chapel Hill.
For primary bibliographic entry see Field 4A.
W80-02917

6F. Nonstructural Alternatives

MANAGING STORM RUNOFF IN CHICAGO AREA,
Metropolitan Sanitary District of Greater Chicago, IL.
For primary bibliographic entry see Field 5G.
W80-02914

6G. Ecologic Impact Of Water Development

CULTURAL RESOURCE INVENTORY OF AREAS AFFECTED BY REJECT STREAM REPLACEMENT PROJECTS,
Westec Services, Inc., San Diego, CA.
W. T. Eckhardt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 335, Price codes: A07 in paper copy, A01 in microfiche. Prepared for the U.S. Department of Interior, Bureau of Reclamation, July 1979. 158 p, 35 Fig, 8 Tab, 125 Ref, 8 Append. 8-07-30-V0041.

Descriptors: *California, *Surveys, *Desalination plants, *Archaeology, Resources, History, Planning, Dating, Vegetation, Deserts, Brines, Environmental effects, Project planning, Data collections, Cultural resources.

Approximately 14,990 acres of East Mesa and Imperial Valley, California, were culturally inventoried in compliance with Federal regulations for areas affected by Federal projects. The Yuma Desalting Plant in Arizona, a Federal project, will reject approximately 42,000 ac-ft of brine per year which it is required to replace with fresh water from other sources. Four alternative sources are: (1) lining a section of the All-American canal, (2) desalting Alamo River Water, (3) desalting geothermal fluid, and (4) extracting groundwater. The alternatives are evaluated by the areas and cultural resources affected. From the field survey 95 cultural resource sites were identified. Three archaeological sites and two districts were nominated for inclusion to the National Register of Historic Places. Recommended mitigation measures for the protection of these historic sites include restricted public knowledge of exact site location, careful construction of roads and other areas so that archaeological sites are avoided, and subsequent archaeological clearance before future development. Also, if it is impossible to design alternative construction to avoid archaeological sites, they must be salvaged prior to any project activity and a reasonable amount of time must be allowed for this. The inventory is designed to be a systematic base for future planning and cultural resource management. (Seigler-IPA)
W80-02738

LAKE REHABILITATION: A STATUS REPORT,
Wisconsin Univ., Madison. Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 2H.
W80-02869

COMPREHENSIVE WATER AND RELATED LAND RESOURCES INVESTIGATION, CONNECTICUT RIVER BASIN. VOLUME I: MAIN REPORT.
New England River Basins Commission, Boston, MA.
For primary bibliographic entry see Field 6E.
W80-02874

COMPREHENSIVE WATER AND RELATED LAND RESOURCES INVESTIGATION, CONNECTICUT RIVER BASIN, VOLUME VII: APPENDICES--K: PLAN FORMULATION; L: NAVIGATION.
New England River Basin Commission, Boston, MA.
For primary bibliographic entry see Field 6E.
W80-02875

PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOUTHEAST RIVER BASINS: SAVANNAH BASIN, APPENDIX 1.
For primary bibliographic entry see Field 6B.
W80-02877

AN ARCHAEOLOGICAL OVERVIEW OF THE MIDDLE AND LOWER SANTA CRUZ BASIN,
Arizona State Museum, Tucson.
D. A. Westfall.
Archaeological Series No 134, P.O. No 0-01-32-04430, June 1979. Prepared for the Arizona Projects Officer, Bureau of Reclamation. 109 p, 10 Fig, 4 Tab, 151 Ref.

Descriptors: *Arizona, *Archaeology, *History, *Vegetation, *Environmental effects, Deserts, Land use, Aqueducts, Water conveyance, Human population, Cacti, Desert plants, Arid lands.

The cultural resource base in parts of Pinal and Pima counties, Arizona, was evaluated to determine the effects of various construction alternatives for the proposed Tucson Aqueduct, a part of the Central Arizona Project. The 1550 square miles of the study area are divided into zones according to vegetation communities: (1) mesquite-saltbush, (2) mixed paloverde-cacti, (3) desert riparian, (4) creosotebush-bursage, (5) desert grassland, (6) upper elevation oak wooded-chaparral pine and spruce, and (7) modern agricultural, urban, roads, and transmission lines. Within the area a variety of prehistoric sites occur including villages, agricultural/horticultural systems, base camps, food gathering/processing sites, hunting/butchering sites, rockshelters, trails, and petroglyphs. A prediction model of cultural resource sensitivity was developed for preliminary planning purposes. For Reach 1, the northern project area, the creosotebush-bursage zone has the lowest number of sinificant sites and the desert riparian zone has the most significant sites. Of the various alternatives, Route I is expected to have the greatest cultural resource impact and Route III the smallest impact. For Reach 2, the southern project area, significant resources are located in all zones and all alternatives are likely to effect significant resources in all zones, however, Route V is the most favorable alternative since it is located away from the Tucson Basin. (Seigler-IPA)
W80-03000

7. RESOURCES DATA

7A. Network Design

DATA NEEDS FOR DISASTER POLICY MAKING,
Wharton School, Philadelphia, PA.
L. Miller, J. Vinso, and H. Kunreuther.
In: Natural Hazards Data Resources: Uses and Needs; Program on Technology Environment and Man, Monograph 27; Institute of Behavioral Science, Colorado University p 81-97, 1979. 2 Fig, 1 Tab.

Descriptors: *Data collections, *Information exchange, *Disasters, Political aspects, Research and development, Planning, Economics, Cost-benefit analysis, Surveys, Data processing, Census, Statistics, Basic data collections.

Data which are accessible, timely, and disaggregate are needed for the development of meaningful policies on the needs of hazard-prone and disaster-stricken areas. Such policy making involves cost and benefit analyses on many dimensions. A framework for data processing in policy making showing the interactive roles of the different groups involved in data generation and information production is presented. Raw data are collected by agencies and researchers. Researchers and special interest groups formulate and test various hypotheses. Staffs and lobbyists evaluate trade-offs and analyze costs and benefits. Governmental policy makers, Federal, State and local, make the actual policy selections. The policies are then interpreted and administered. Experience from policy administration then generates more raw data and the cycle begins again. In order for the data to be valuable to various users it must be organized. Natural hazard information is organized into three stages: (1) initial specification of the risk area; (2) specification of a disaster and its immediate physical, financial, and personal impacts prior to recovering; and (3) recovery and mitigation measure impacts. A table of user and disaster data for different groups is provided and data source agencies are recommended, source agencies included The Red Cross, The Small Business Administration, The Farmer Home Administration, The Corps of Engineers, and the Federal Insurance Administration. (Seigler-IPA)
W80-02808

7B. Data Acquisition

GEOPHYSICAL STUDIES OF THE HYDRAULIC PROPERTIES OF GLACIAL AQUIFERS IN THE PAWCATUCK RIVER BASIN, R.I.,
Rhode Island Univ., Kingston. Dept. of Geology.
R. K. Frohlich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134703, Price codes: A03 in paper copy, A01 in microfiche. Rhode Island Water Resources Center, University of Rhode Island. Project Report, November 1979. 38 p, 19 Fig, 10 Ref, OWRT A-068-RI (1).

Descriptors: *Rhode Island, *Hydrogeology, *Groundwater basins, *Aquifers, Aquifer systems, Geohydrologic units, Glaciohydrology, Seismic studies, Gravity, Depth, Drilling, Aquifer characteristics, Groundwater, Water sources, Refractivity.

The potential of geophysical methods for groundwater exploration was studied in the Upper and Lower Wood River area of southern Rhode Island. In the area a complexity of aquifers is associated with glacial stream channels, however, only some of the aquifers are sufficiently large for groundwater use. To locate and classify these aquifers three geophysical techniques were used: a gravity survey, geophysical depth sounding, and seismic refractivity profiles. Fifteen gravity profiles were taken across the area in an east-west direction with a La Costa and Romberg, Model G, gravimeter and the Bouguer anomaly was obtained by subtracting normal gravity from observed gravity. Seven geoelectrical depth soundings were conducted and sounding curves are presented. Layer

velocities, thicknesses, and depth to bedrock were studied with twenty-one reserved seismic refraction profiles. None of these methods alone can identify optimal aquifer locations therefore it is recommended that all three be used to reduce or more efficiently organize exploratory drilling. Figures are presented illustrating results for each of the geophysical methods including Bouguer anomaly, gravity profiles, transmissivity maps, depth sounding curves, seismic refraction profiles, and velocity-depth profiles. (Seigler-IPA)
W80-02770

NUMERICAL COMPUTATION OF AVALANCHE MOTION,
Department of the Environment, Calgary (Alberta).
T. T. Cheng, and R. Perla.
Available from Inland Waters Directorate, Environment Canada, Ottawa, Ontario, Canada KLA 0E9. NHRI Paper No 5, 1979. 12 p, 1 Tab, 2 Fig, 3 Ref.

Descriptors: *Avalanches, *Computer models, Snow, Velocity, Probability, Path.

A computer program named ACCEL has been designed to process avalanche path data. Given path geometry, friction coefficients and dynamic parameters, ACCEL computes avalanche speeds at selected positions along the path and prints out the position at which the avalanche stops. This publication gives a complete set of instructions on how to use ACCEL. A brief description of the basic theories and methods employed in the program are given. The input-output data and formats are described in detail with examples. A program listing and flowchart are also included. (WATDOC)
W80-02845

RECOMMENDED METHODS FOR WATER DATA ACQUISITION--A FEDERAL/NON-FEDERAL ACTIVITY TO DEVELOP STANDARD METHODOLOGY,
Geological Survey, Reston, VA. Water Resources Div.
A. I. Johnson, G. L. Knapp, and F. P. Kapinos.
In: Proceedings of the 4th Joint Conference on Sensing of Environmental Pollutants, held in New Orleans, Louisiana, November 6-11, 1977: American Chemical Society, p 351-353, 1978. 1 Fig.

Descriptors: *Data collections, *Methodology, *Surface waters, *Groundwater, *Water quality, Water sampling, Water analysis, Water yield, Sedimentation, Measurement, Networks, Documentation, Reviews, *Data collections handbook.

To coordinate data collection activities, the U.S. Geological Survey's Office of Water Data Coordination (OWDC) is publishing the 'National Handbook of Recommended Methods for Water-Data Acquisition.' Prepared by OWDC with the help of advisory committees and working groups from both Federal and non-Federal organizations, the 'National Handbook' recommends methods for acquiring data on surface water, ground water, chemical and biological water quality, sediment, soil moisture, drainage-basin characteristics, evaporation and transpiration, snow and ice, and hydrometeorology. The Coordinating Council, which consists of representatives from 18 Federal agencies, and a working group of the Advisory Committee on Water Data for Public Use, which consists of representatives of non-Federal organizations, provide policy guidance. The Coordinating Council was designated as the Federal Metric Panel for Hydrology and is responsible for recommending (1) metric units, (2) precision of metric measurement, and (3) metric conversion of equipment. The 'National Handbook' will emphasize use of the SI metric system. (Woodard-USGS)
W80-02933

A SUPPLEMENT TO--METHODS FOR COLLECTION AND ANALYSIS OF AQUATIC BIOLOGICAL AND MICROBIOLOGICAL SAMPLES (U.S. GEOLOGICAL SURVEY TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS, BOOK 5, CHAPTER A4),
Geological Survey, Reston, VA. Water Resources Div.
Geological Survey open-file report 79-1279, August 1979. 92 p, 1 Tab, 84 Ref. Greeson, P. E., editor.

Descriptors: *Analytical techniques, *Water sampling, *Water analysis, *Aquatic populations, Biological communities, Microbiology, Methodology, Enteric bacteric, Biomass, Chlorophyll, Diatoms, Periphyton, Phytoplankton, *Sample preservation.

The manual contains methods used by the U.S. Geological Survey to collect, preserve, and analyze waters to determine their biological and microbiological properties. It supplements 'Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples' (TWRI, Book 5, Chapter A4, 1977, edited by P. E. Greeson, T. A. Ehlke, G. A. Irwin, B. W. Lium, and K. V. Slack). Included are 5 new methods, a new section of selected taxonomic references for Ostracoda, and 6 revised methods. (Woodard-USGS)
W80-02936

7C. Evaluation, Processing and Publication

METHODS OF COMPARING ANNUAL RAINFALL RECORDS FOR CLIMATIC PURPOSES,
University of East Anglia, Norwich (England). Climatic Research Unit.
For primary bibliographic entry see Field 2B.
W80-02867

GROUND-WATER RESOURCES AND MODEL APPLICATIONS FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER IN THE SAN ANTONIO REGION, TEXAS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W80-02883

WATER RESOURCES DATA FOR UTAH, WATER YEAR 1978.
Geological Survey, Salt Lake City, UT. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119621, Price codes: A21 in paper copy, A01 in microfiche. Geological Survey Water-Data Report UT-78-1, August 1979. 492 p, 7 Fig.

Descriptors: *Utah, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Utah consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 255 gaging stations; stage and contents for 21 lakes and reservoirs; water quality for 34 hydrologic stations, 186 partial-record stations, and 275 wells; and water levels for observation wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Utah. (Woodard-USGS)
W80-02924

WATER RESOURCES DATA FOR MICHIGAN, WATER YEAR 1978.
Geological Survey, Lansing, MI. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-117013, Price codes: A20 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MI-78-1, July 1979. 451 p, 9 Fig.

Descriptors: *Michigan, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Michigan consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water temperature of ground water. This report contains discharge records for 187 gaging stations, stage only records for 1 gaging station, stage and contents for 5 lakes and reservoirs, water quality for 65 continuous-record stations and 6 lakes, and water levels for 45 observation wells. Also included are 93 crest-stage partial-record stations and 18 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal Agencies in Michigan. (Woodard-USGS)
W80-02925

WATER RESOURCES DATA FOR IOWA, WATER YEAR 1978.
Geological Survey, Iowa City, IA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116676, Price codes: A12 in paper copy, A01 in microfiche. Geological Survey Water-Data Report IA-78-1, July 1979. 256 p, 6 Fig.

Descriptors: *Iowa, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Iowa consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 118 gaging stations, stage and contents for 5 lakes and reservoirs, water quality for 22 gaging stations, and water levels for 32 observation wells. Also included are 124 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. The data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Iowa. (Woodard-USGS)
W80-02926

WATER RESOURCES DATA FOR CONNECTICUT, WATER YEAR 1978.
Geological Survey, Hartford, CT. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-117583, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CT-78-1, June 1979. 363 p, 4 Fig.

Descriptors: *Connecticut, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Connecticut consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report contains records for water discharge at 52 gaging stations; tidal volume for 1 gaging station; stage only records for 3 tidal-gaging stations; contents for 36 lakes and reservoirs; water quality for 52 gaging stations, 6 lakes and reservoirs, 62

wells, 1 spring, and 1 chemical precipitation station; and water levels for 21 observation wells. Also included are 41 crest-stage and 34 low-flow partial-record stations. Additional water data were collected at various sites not part of the systematic data-collection program and are published as miscellaneous measurements and analyses. A few pertinent stations (not included above) in bordering States are also included in this report. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Connecticut. (Woodard-USGS)
W80-02927

WATER RESOURCES INVENTORY OF CONNECTICUT, PART 8, QUINNIPIAC RIVER BASIN,
Geological Survey, Hartford, CT. Water Resources Div.
D. L. Mazzaferro, E. H. Handman, and M. P. Thomas.
Connecticut Water Resources Bulletin No 27, 1978. 88 p, 56 Fig, 5 Plates, 36 Tab, 149 Ref.

Descriptors: *Connecticut, *Water resources, *Surface waters, *Groundwater resources, *Water quality, Reviews, Projects, Hydrologic data, Water utilization, Water demand, Available water, Hydrology, Water analysis, Chemical analysis, Streamflow, Runoff, Floods, Aquifer characteristics, Model studies, Data collections, Evaluation, *Quinnipiac River basin(Conn).

The 363 square mile Quinnipiac River basin area received an average of 47 inches of precipitation during the 1931-60 period; runoff and evapotranspiration averaged 26 and 21 inches respectively. The 90-percent duration flow of the Quinnipiac River at its mouth exceeds 50 Mgal/d (million gallons per day). Yields of 64 screened wells tapping stratified drift range from 17 to 2,000 gal/min (gallons per minute); the median yield is 500 gal/min. Long-term yields estimated for 14 favorable areas of stratified drift range from 0.8 to 16.1 Mgal/d. Wells in till generally yield a few hundred gallons of water daily. Water in bedrock supply modest amounts of water throughout the area; median yields range from 7 to 10 gal/min. Surface-water samples collected at 20 sites in the area had median dissolved-solids concentrations of 117 mg/L (milligrams per liter) at high flow and 146 mg/L at low flow. Ground-water samples from 130 wells had a median dissolved-solids concentration of 188 mg/L. High concentrations of iron, manganese, and hardness, and saltwater intrusion cause water-quality problems in parts of the area. In 1970, freshwater use was estimated at 35,710 million gallons. (Woodard-USGS).
W80-02930

8. ENGINEERING WORKS

8A. Structures

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 1: PACIFIC NORTHWEST REGION,
Institute for Water Resources (Army)., Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 1 of 6, July 1979. 242 p, 4 Fig, 6 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, *Pacific Northwest U.S., Electric power, Washington, Oregon, Idaho, Alaska, Energy, Reservoirs, Damsites, Surveys, Electric generators, Powerplants.

Potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried for the Pacific Northwest states of Washington, Oregon, Idaho, and Alaska. This area has the largest portion of the nation's installed capacity and generates 48% of the country's hydroelectric total. Estimates of total potential for the region exceed 327,000 MW of which 26,800 MW have been installed. Another 33,300 MW could be produced by upgrading and expanding existing plants while the capacity for new installations is 267,500 MW. Of the installed capacity, most are large units with small units accounting for only 2% of the total. Tables are presented giving capacities for the six national regions (Pacific Northwest, Pacific Southwest, Mid-Continent, Lake Central, Southeast, and Northeast). Tables of state-by-state estimates for all existing, incremental, and developed sites in the Pacific Northwest are also provided. The tables include project name, river name, owner, location, drainage area, and various capacity values. Basic data on existing facilities taken from the Corps' National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02718

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 2: PACIFIC SOUTHWEST REGION,
Institute for Water Resources (Army), Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 2 of 6, July 1979. 136 p, 4 Fig, 7 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, *Southwest U.S., Electric power, Hawaii, California, Nevada, Utah, Arizona, Energy, Reservoirs, Damsites, Surveys, Electric generators, Powerplants.

National potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried and the results are presented for the Pacific Southwest states of Arizona, California, Hawaii, Nevada, and Utah. This area has approximately 6% of the total potential capacity for the United States. Of the 33,000 MW of potential capacity only 9,900 MW have been installed. Another 6,000 MW could be realized by upgrading and expanding existing projects. Less than 4% of the total installed capacity is produced by small-scale facilities. Tables are presented giving capacities for the six national regions (Pacific Northwest, Pacific Southwest, Mid-Continent, Lake Central, Southeast, and Northeast). Tables of state-by-state estimates for all existing, incremental, and developed sites in the Pacific Southwest are also provided. The tables include project name, river name, owner, location, drainage area, and various capacity values. Basic data on existing facilities were taken from the Corp's National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02719

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 3: MID-CONTINENT REGION,
Institute for Water Resources (Army), Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 3 of 6, July 1979. 247 p, 4 Fig, 12 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, Montana, Wyoming, Colorado, New Mexico, Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Energy, Reservoirs, Damsites, Surveys, Electric generators, Powerplants.

National potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried and results are presented for the Mid-Continent states of Montana, Wyoming, Colorado, New Mexico, Texas, Oklahoma, Kansas, Nebraska, South Dakota, and North Dakota. For the area, a maximum potential of 44,000 MW represents approximately 9% of the nation's total potential. Of the total estimated capacity for the area, only 6,500 MW have been installed. By upgrading and expanding existing facilities another 7,800 MW could be realized leaving a potential 29,900 MW undeveloped. Less than 3% of the total installed capacity is in the form of small-scale facilities. Colorado, Texas, and Montana have the largest potential for incremental development. Tables are presented giving capacities for all six national regions. Tables of state-by-state estimates for all existing, incremental, and developed sites in the Mid-Continent region are also provided. The tables include project name, river name, owner, location, drainage area, and various capacity values. Basic data on existing facilities were taken from the Corps' National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02720

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 4: LAKE CENTRAL REGION,
Institute for Water Resources (Army), Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 4 of 6, July 1979. 214 p, 4 Fig, 11 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, Minnesota, Iowa, Missouri, Illinois, Wisconsin, Michigan, Indiana, Kentucky, Ohio, Energy, Reservoirs, Damsites, Surveys, Electric generators, Powerplants.

National potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried and results are presented for the Lake Central states of Minnesota, Iowa, Missouri, Wisconsin, Illinois, Kentucky, Indiana, Michigan, and Ohio. The estimated 26,000 MW of potential energy in the area represents approximately 5% of the nation's total. In the area 2,600 MW have been installed. By expanding and upgrading existing facilities another 15,800 MW could be realized. Installing powerplants at the remaining potentially feasible sites would produce an additional 7,800 MW. The region has a large percentage (24%) of small-scale plants especially in Michigan and Wisconsin. Tables are presented giving capacities for all six national regions (Pacific Northwest, Pacific Southwest, Mid-Continent, Lake Central, Southeast, and Northeast). Tables of state-by-state estimates for all existing, incremental, and developed sites in the Lake Central region are also provided. The tables include project name, owner, location, drainage area, and various capacity values. Basic data on existing facilities were taken from the Corps' National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02721

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 5: SOUTHEAST REGION,
Institute for Water Resources (Army), Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 5 of 6, July 1979. 194 p, 4 Fig, 12 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Virginia, North Carolina, South Carolina, Florida.

National potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried and results are presented for the Southeast states of Arkansas, Louisiana, Mississippi, Alabama, Tennessee, Georgia, Florida, South Carolina, North Carolina, and Virginia. The inventory shows that the maximum physical potential for all sites in the Southeast region is approximately 48,000 MW. This amount represents about 9% of the national total. Of the potential inventoried only 11,800 MW have been installed. By upgrading and expanding existing facilities another 13,000 MW could be produced. Installation of new facilities at the remaining useful undeveloped sites would produce another 23,200 MW. Approximately 2% of the regions facilities are small scale -- mostly located in North Carolina and South Carolina. Tables are presented giving capacities for all six national regions. Tables of

state-by-state estimates for all existing, incremental, and developed sites in the Southeast region are given. The tables include project name, owner, location, drainage area, and various capacity values. Basic data on existing facilities were taken from the Corps' National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02722

NATIONAL HYDROELECTRIC POWER RESOURCES STUDY, PRELIMINARY INVENTORY OF HYDROPOWER RESOURCES, VOLUME 6: NORTHEAST REGION,
Institute for Water Resources (Army), Fort Belvoir, VA.
W. R. Sigleo, J. R. Hanchey, and D. G. Nolton.
Vol 6 of 6, July 1979. 314 p, 4 Fig, 14 Tab, 3 Append.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Dams, Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, West Virginia.

National potentially feasible hydropower resources from both existing dams and undeveloped sites were preliminarily inventoried and results are presented for the Northeast states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Delaware, New Jersey, New York, Pennsylvania, Rhode Island, and West Virginia. Although undeveloped hydropower potential data was not available for six of the states, it is estimated that the region has a potential of 33,000 MW. This amount represents about 11% of the nation's total potential. Only 6,100 MW of the regions potential has been installed. Upgrading and expanding existing facilities could result in an additional 18,700 MW. Development of the other potential sites would produce 8,500 MW. The states with the highest potential for incremental development are New York, Maine, and New Hampshire. Tables are presented giving capacities for all six national regions. Also, tables of state-by-state estimates for all existing, incremental, and developed sites in the Southeast region are given. The tables include project name, owner, location, drainage area, and various capacity values. Basic data on existing facilities were taken from the Corps' National Inventory of Dams which lists approximately 50,000 dams. (Seigler-IPA)
W80-02723

DERELICTION OF ASSETS,
North West Water Authority, Warrington (England).
J. Lloyd.
Water, No 28, p 48-50, September 1979. 1 Fig.

Descriptors: *United Kingdom, *Sewage districts, *Water delivery, Waste water disposal, Sewage disposal, Sewage, Pipes, Storm drains, Combined sewers, Urbanization, Storm water, Maintenance costs, Replacement costs.

After 50 years of neglect the North West Water Authority, United Kingdom, has adopted a policy of orderly maintenance, renewal, and replacement for its underground water system assets. Much of the currently used system is quite old, some dating to the industrial revolution of the late 18th century. Underground facilities tend to be neglected because they are out of sight, are initially expensive, and are expected to have a long service life. The North West Water Authority has widespread evidence of dilapidation such as frequent sewer collapses and burst water mains, storm sewer overflows, flooding of roads and houses, dirty water from encrusted mains, and varying water supply and pressure. The Authority's underground assets to be maintained include 36,000 Km of water mains and 30,000 Km of sewers. Improved arrangements for regular maintenance and renewals have been made. It is expected that water rates will be increased to allow for repairs of the underground system. Organizational and staff requirements are also being considered. A vigorous public campaign has been mounted to prepare the public for increased rates and expenditures. Recent large sewer collapses in Manchester have helped to make the public aware of the problem. (Seigler - IPA)
W80-02756

PLANNING MAINTENANCE,
Lothian Region Council, Edinburgh (Scotland).
L. Freeman.
Water, No 28, p 52-53, September 1979. 1 Fig.

Descriptors: *United Kingdom, *Sewage districts, *Sewage disposal, Sewerage, Pipes, Urbanization, Maintenance costs, Replacement costs, Public utilities, Public benefits.

Harry O'Hanlon, deputy director of drainage for the Lothian Regional Council feels that the sewer system in Edinburgh, Scotland, is not in danger of collapse. There is currently much concern for the condition of sewer systems in the United Kingdom due to their age and lack of prior comprehensive maintenance programs. Edinburgh recently installed a new sewage disposal system and stopped discharging untreated sewage into the Firth of Forth. This year the city plans to conduct an inspection and maintenance program for its 100 miles of trunk sewers. Ten men forming two teams will work mainly at night to do minor repairs and to report larger problems for contract repair. For two years the city has been conducting an inspection of it smaller sewers by television. Overall it is believed that the sewer system is in good repair although some trouble spots are likely. O'Hanlon believes that the public scare about decaying sewers is unwarranted. (Seigler - IPA)
W80-02757

8B. Hydraulics

ADEQUACY OF DATA RESOURCES FOR THE NEEDS OF THE CONSULTING ENGINEER TO LOCAL GOVERNMENT,
Wright Water Engineers, Inc., Denver, CO.
K. R. Wright, P. D. Binney, and M. M. Stokes.
In: Natural Hazards Data Resources: Uses and Needs; Program on Technology, Environment and Man, Monograph 27; Institute of Behavioral Science, Colorado University, p 44-53, 1979.

Descriptors: *Flood data, *Flood damage, *Engineering personnel, *Data collections, Hydrologic data, On-site data collections, Hazards, Floodproofing, Warning systems, Flood forecasting, Building codes, Flood protection, Runoff, Urbanization, Mapping.

Consulting engineers are often used by local governments for hazard research especially in the costly area of flooding. Engineers develop design criteria, conduct original research, and assist in the development of building coeds. They help reduce flood damage by improving drainage and control structures, by refining warning systems and floodproofing techniques, and by improving or extending forecasting. Consulting engineers must rely largely on data resources that in many cases are not adequate or site specific. Data needed include hydrologic data, mapping, flood-frequency reliability, runoff, urbanization, stage-damage frequency relationships, urban storm drainage, and control structure hydraulics. Consulting engineers can also participate in hazard data dissemination, disaster planning, and in nonstructural methods of flood management. Nonstructural methods include floodproofing and flood warning. The consulting engineer also needs to work actively with other professionals such as political and social scientists and economists in the reduction of flood losses. (Seigler-IPA)
W80-02806

8C. Hydraulic Machinery

AN ELECTRIC CONVERSION FOR MECHANICAL-HYDRAULIC GOVERNORS OF WATER WHEEL TURBINES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. L. Clemans, L. E. Eilts, and F. R. Schleif.
Available from the National Technical Information Service, Springfield, VA 22161. Report No REC-ERC-79-16, December 1979. 48 p, 26 Fig, 4 Ref, 3 Append.

Descriptors: *Governors, *Mechanical equipment, *Hydraulic turbines, Hydraulic equipment, Control systems, Mechanical control, Testing procedures, Power system operation, Electronic equipment, Stability, Velocity, Coordination, Performance, Research and development.

Conventional mechanical-hydraulic governors can be up-graded by a simple conversion system to improve sensitivity, linearity, and speed response to small speed deviations without degrading stability of speed control. All of this can be accomplished simply without extensive expense, outage of time or sacrifice of ruggedness or high reliability. The conversion upgrades governor systems from temporary-droop type to a high order double-derivative type by replacing the dashpot function with derivative terms from an independent frequency sensor. A velocity feedback system around the valves and servomotor simplify the gate response function and aid in gate timing adjustment. Installation is simple and control can be transferred instantly since all original mechanical apparatus is retained for startup and standby. The apparatus is schematically described in detail with information on tests and alinement of electrical governors and mechanical governors by simulated isolation and trouble shooting aids. (Seigler-IPA)
W80-02717

WATER FLOW-DEFLECTING SHIELD FOR DREDGE SUCTION NOZZLE,
Deepsea Ventures, Inc., Gloucester Point, VA. (Assignee).
R. M. Donaldson, T. W. Christian, and G. E. Miller.
U.S. Patent No 4,171,581, 6 p, 4 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 987, No 4, p 799, October 23, 1979.

Descriptors: *Patents, *Dredging, Exploration, *Oceans, Flow control, Hydrodynamics, Nozzles, Intakes, Hydraulic equipment, Suction dredges, Deep-sea mining.

The object of the invention is to provide means to improve the effectiveness of a dredge head in removing nodules and other ore of a like particulate nature from the ocean floor. The dredge head comprising a suction nozzle having a nozzle inlet located adjacent the bottom of the nozzle is operatively connected to water-deflecting means, located forward of the nozzle and is designed to defelct water flowing towards the nozzle downward towards the nozzle opening. The nozzle opening is facing in a generally forward, and most preferably obliquely downward direction. The combination of the effect of the downwardly deflected water and of the obliquely opening nozzle improves the ability of the nozzle to recover particulate material along its path. In a preferred embodiment, the nozzle presents a vertically elongated surface facing forward towards the free-stream flow of water and is pivotally connected to the vehicle. (Sinha - OEIS)
W80-02897

8D. Soil Mechanics

A COMPARISON OF ELECTRONIC AND PIPET METHODS FOR MECHANICAL ANALYSIS OF SOILS,
Idaho Univ., Moscow. Dept. of Plant and Soil Sciences.
K. L. Pennington, and G. C. Lewis.
Soil Science, Vol 128, No 5, p 280-284, November 1979. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Soil analysis, *Laboratory tests, *Testing procedures, *Particle size, Testing, Methodology, Measurement, Analytical techniques, Clays, Silts.

An electronic method was developed and compared to the pipet method for determining particle size distribution of 43 samples representing a wide

variety of Idaho soils. The Coulter Counter model TAII was used for the electronic method. Thirty-seven of the 43 samples had the same textural classification by both the electronic and pipet methods. There was significant correlation between the two methods in the amounts of clay and silt found in the soil samples. Approximately twice as many samples can be run by the electronic method in the same amount of time as by the pipet method. Sample concentrations were kept below 5% deflection of the concentration index meter, 2 to 4% being optimum. This allowed for minimum coincidence error while keeping counting time between 2 to 5 min for most samples. Filtering all water through a 0.45- and 0.22- micrometer filter system prior to preparing the electrolyte solutions, and filtering the electrolyte solutions through another 0.45- and 0.22 micrometer system prior to use, effectively eliminates background noise due to contamination. (Humphreys-ISWS)
W80-02862

8I. Fisheries Engineering

SUMMARY OF CENTRAL STATES FISHERY STATION STRIP MINE LAKE PROJECT REPORTS 1973-1978,
Fish and Wildlife Service, Princeton, IN. Central States Fishery Station.
R. S. Glesne, and C. J. Surprenant.
In: Surface Mining and Fish/Wildlife Needs in the Eastern United States, Report No FWS/OBS-78/81 A, p 123-125, 1979.

Descriptors: *Lake fisheries, *Fish management, *Strip mine lakes, Acidic water, Mine wastes, Fish establishment, Infrared radiation, Analytical techniques, Illinois, Iowa, Ohio, Fish food organisms, Zooplankton, Catfishes, Yellow perch, Minnows, Shiners,.

Progress in fisheries management of strip mine lakes in Illinois, Indiana, and Ohio is reported as summaries of six fishery station biologist reports. Illinois, Indiana, and Ohio have few natural lakes, however, they do have an estimated 26,000 acres of strip mine lakes that will produce an estimated 156,000 surface acres of lakes after reclamation. Strip mine lakes have unique physiochemical properties that make standard natural lake or reservoir management practices unapplicable to them, therefore new management practices must be developed. To investigate the suitability of mine waters for several species of fish five Indiana lakes were renovated. Data were collected on fish standing crop, growth, and population structure. Fish species included in the study were yellow perch, smallmouth bass, largemouth bass, bluegills, channel catfish, fathead minnows, and golden shiners. Three of the report summaries concern the fertilization of strip mine lakes. Four southern Indiana lakes were stocked with fish and fertilized. First year data from these lakes indicate little beneficial effects from the fertilization. However, other fertilization studies in other lakes reported more diversity and density of benthic organisms and improved growth of young largemouth bass. The use of color infra-red photography to determine strip mine lake water quality is also reported. Visual color differences were observed between acid and nonacid sites and various other water qualities could be detected by color differences. (Seigler-IPA)
W80-02811

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

THE MEANS AND ENDS OF PUBLIC PARTICIPATION,
Wisconsin Univ. Extension, Madison. Environmental Resources Unit.
L. L. Klessig.
In: Lake Restoration, Report No EPA 440/5-79-001, p 27-31, 1979, 5 Tab, 13 Ref.

Descriptors: *Wisconsin, *Water management(Applied), *Lakes, *Water districts, Lake stages, Water quality, Water pollution control, Watersheds(Basins), Education, Governments, Regional economics, Taxes.

Public participation by local property owners and local communities in lake management programs is an important factor in the success of a program. Education is an essential part of public participation, but education alone is not enough. Areas of needed public education on lake management include the lake ecosystem, potential for management success, and organizational options. Operating examples of organizational options are over 100 lake communities in Wisconsin that have formed lake districts. The districts give the public a voice in decisions on boundaries, functional jurisdictions, equity, and voting rights as they relate to lake management projects. Public participation techniques need to be designed so that they are appropriate to their function. Seven techniques utilized in the Wisconsin lake management programs are evaluated. A third important factor in public participation is the need for an appropriate degree of parochialism on the part of lake management professionals. A concern and understanding of self-interest is necessary to motivate the public. Use of this approach in Wisconsin lake management programs resulted in a reduced possibility of community conflict and distrust of the government and an increased potential for community pride, project support, and improved relations. (See also W80-02773) (Seigler-IPA)
W80-02778

9D. Grants, Contracts, and Research Act Allotments

ACHIEVING THE 1983 WATER QUALITY GOALS,
Environmental Protection Agency, Washington D.C. Water Planning Div.
S. T. Davis.
In: Lake Restoration, Report No EPA 440-5-79-001 p. 11-15, 1979.

Descriptors: *Federal Water Pollution Control Act, *Water quality control, *Government finance, Legislation, Water Quality Act, Water pollution, Waste treatment, Recreation, Swimming, Fishing, Discharge(Water), Lakes, Government supports, Planning, Management, Grants, Monitoring, Environmental Protection Agency, Governmental interrelations, State governments.

The Clean Act of 1972 identified the goals of eliminating pollunt discharges by 1985 establishing water quality levels sufficient for recreational activities and wildlife and fish protection. The Environmental Protection Agency (EPA) was aurorized to provide technical and financial assistance to aid in attaining these goals. However, the large number of programs and lack of coordination greatly showed the implementation process at the local level. Emphasis is now being placed on State/EPA agreements to facilitate the implementation of the various programs and funds. The Clean Water Act Amendments of 1977 are expected to encourage more small town use of construction grants for waste treatment systems by simplifying government requirements of the states and local areas. Beginning in 1980, State/EPA agreements will be expanded and will involve all of the programs under the Resource Conservation and Recovery Act and the Safe Drinking Water Act. It is hoped that States will begin to develop overall environmental planning and management programs instead of making small individual efforts. Program coordination efforts are suggested for: (1) data collection for population and wasteload projections for all programs, (2) monitoring efforts for all programs, (3) water quality assessments for both surface and ground-water resources, (4) effective facility planning, and (5) wasteload allocations. (See also W80-02773) (Seigler-IPA)
W80-02775

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition And Processing

WESTERN COAL PLANNING ASSISTANCE PROJECT: SOURCE BOOK FOR WESTERN COAL/ENERGY DEVELOPMENT.
Mountain West Research, Inc., Billings, MT.
Missouri River Basin Commission; Resource and Land Investigations Program (USGS), January 1979. 263 p, 13 Fig, 4 Tab.

Descriptors: *Information retrieval, *Data collections, *Coal mines, *Montana, *North Dakota, *Wyoming, Future planning(Projected), Bibliographies, Documentation, Libraries, Publications, Reviews, Aerial photography, Forecasting, Energy, Long-term planning.

Sources of information on coal-energy development are presented to aid local planners and decision makers as part of the Planning Reference System developed by the Western Coal Planning Assistance Project (WCPAP). WCPAP is designed to aid State and local planners and decision makers in the development of technical methods and information required to cope with coal-energy development problems. The project involves major coal areas in Montana, North Dakota, and Wyoming. Information sources included are those for published and unpublished documents, library facilities and bibliographic retrieval systems, data files and information systems, maps and aerial photographs, technical assistance, and financial assistance. The sources given are designed as backup references for forecasts, facts, and methods presented in other parts of the WCPAP Planning Reference System. The focus of the sources is on the local concerns of coal-energy development. Sources were selected based on their quality, appropriateness, and currency. The sources are divided into two major groups, information/data sources and technical assistance and funding. Also, to assist system users an extensive glossary is provided. (Seigler-IPA)
W80-02713

10D. Specialized Information Center Services

DIRECTORY OF MEMBER ORGANIZATIONS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX),
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards, and J. M. Nokes.
Geological Survey open-file report 79-1075 (supersedes open-file report 78-872), 1979. 50 p, Append.

Descriptors: *Information retrieval, *Data storage and retrieval, *Water resources, *Information exchange, *Organizations, Cooperatives, *National Water Data Exchange(NAWDEX), Directory, Member organizations.

The National Water Data Exchange (NAWDEX) is a national confederation of water-oriented organizations working together to improve access to water data. It consists of member organizations from all sectors of the water-data community. This Directory provides the names, addresses, and telephone numbers of all NAWDEX member organizations and their designated NAWDEX representatives. (Woodard-USGS)
W80-02934

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